SCIENTIFIC AMERICAN

· GRAND · CENTRAL · TERMINAL ·

Drawn by Jules Guerin.

· A · MONUMENTAL · GATEWAY · TO · AMERICA'S · GREATEST · CITY ·

Vol. CVII. No. 23.
December 7, 1912.

Munn & Co., Inc., Publishers.

Price
15 Cents

Overland

$985 Completely Equipped

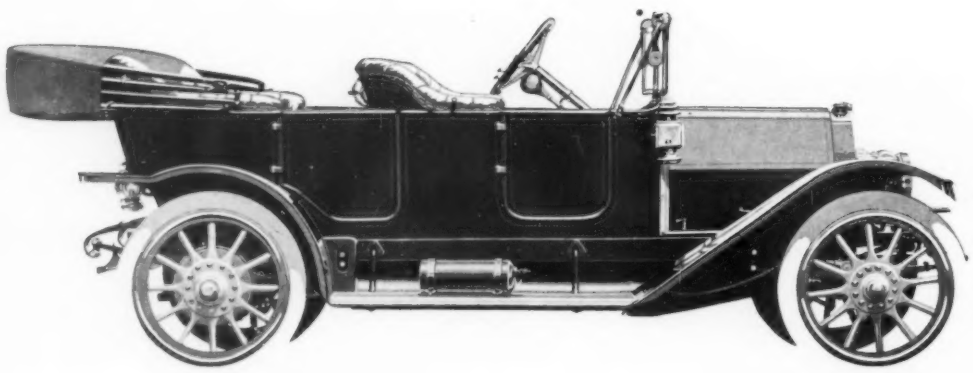
Self-Starter	Timken Bearings	Mohair Top and Boot
30 Horse-power	Center Control	Clear Vision-Rain-Vision
5-Passenger Touring Car	Remy Magneto	Wind Shield
110-Inch Wheel Base	Warner Speedometer	Prestolite Tank

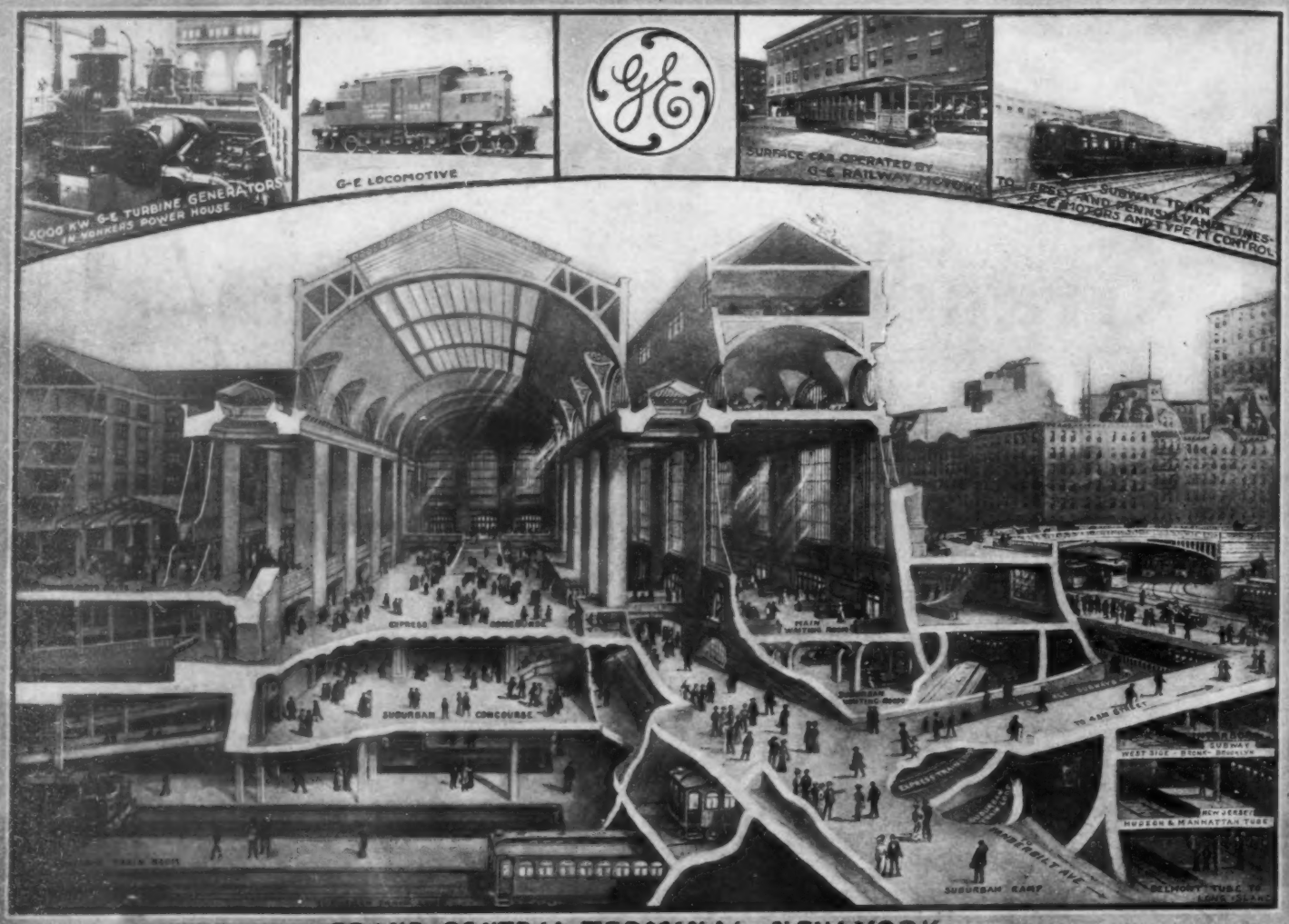
¶ In six years we have jumped from 400 cars a year to 40,000 cars a year. This is an increase of nearly 10,000 per cent. This growth is greater than that of any other single concern in the industry. This growth is greater than the growth of the combined factories of the world.

¶ The Overland, by virtue of this unusual act of implicit confidence, warm appreciation, and exceptional recognition, is today the most prominent, permanent and popular car of its type produced.

(Handsome catalogue on request. Please address Dept. 27)

The Willys-Overland Company, Toledo, Ohio





GRAND CENTRAL TERMINAL—NEW YORK

The World's Largest Railroad Terminal

will save many minutes in the time of travel in and about New York. But did you ever stop to think that this mammoth station would be an impossibility without modern developments in the application of electricity?

The Hudson tubes, a marvelous engineering feat in themselves, would be impracticable if operated by steam trains. The safe speed of suburban and express trains, if stripped of their faithful electric signals, control and automatic stop mechanisms, would be greatly reduced.

The operation of the various sub levels which bring the many routes of travel under one roof, would be impossible if steam trains were used and the problem of lighting the mammoth station would remain unsolved.

The Source of the Electric Power which produces these modern facilities to travel is found in the Curtis Steam Turbine made by the General Electric Company. At Yonkers and Port Morris for instance these turbines can produce over 50,000 H.P. every hour in the day. Power produced at these and similar plants is transmitted at high voltage alternating current and converted to direct current by rotary converters at the various substations which supply current to the terminal, elevated, subway or surface cars as the case may be.

The highly successful operation of the electric street car is now supplemented by the operation of electric cars in trains on the elevated and subway lines. Sprague G-E Type M control enables quick additions or dropping of cars from trains and produces the remarkable reliability of train operation secured.

Powerful electric locomotives haul the Pullman and express trains with perfect safety and reliability even during the worst winter storms, and thousands of commuters profit daily by the clean and reliable service produced by General Electric Company's modern railway developments.

In the Station, evidences of electricity are again found in the brilliant illumination, the motors on the fans and many applications of motors to the transfer of baggage, mails, elevators, etc.

At a time when all eyes are turned to the completion of such projects as the Grand Central Terminal, the Catskill Aqueduct and the Panama Canal, the General Electric Company presents this brief description of the features which are the result of over 20 years experiment, research and experience in the production of electrical apparatus. The G-E trademark is the Guarantee of Excellence on Goods Electrical, not only in large Railway and Engineering projects, but in all kinds of electrical devices for everybody, everyway, everywhere.

General Electric Company

General Office: Schenectady, N. Y. Largest Electrical Manufacturer in the World Sales Offices in All Large Cities

SIXTY-EIGHTH YEAR

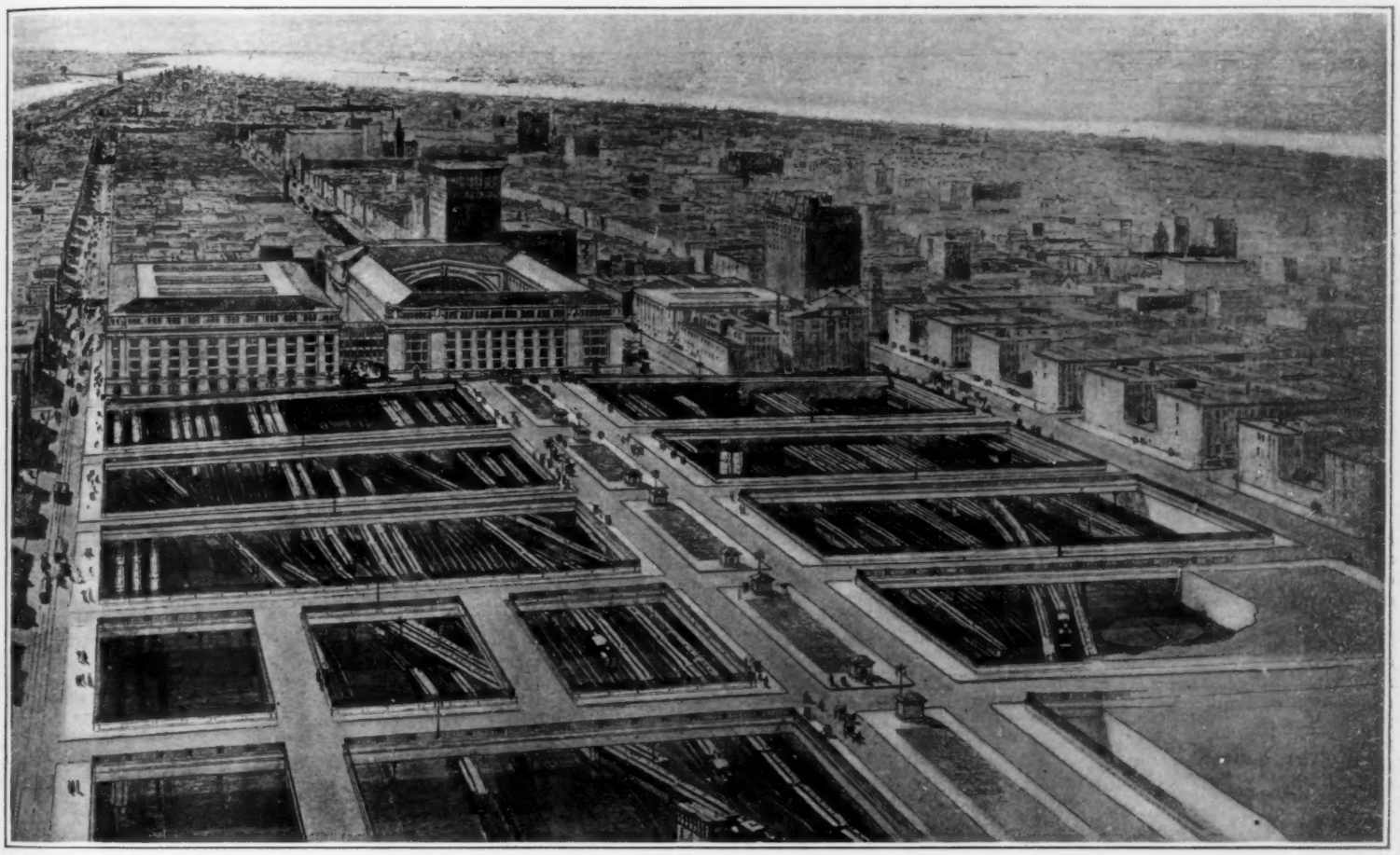
SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

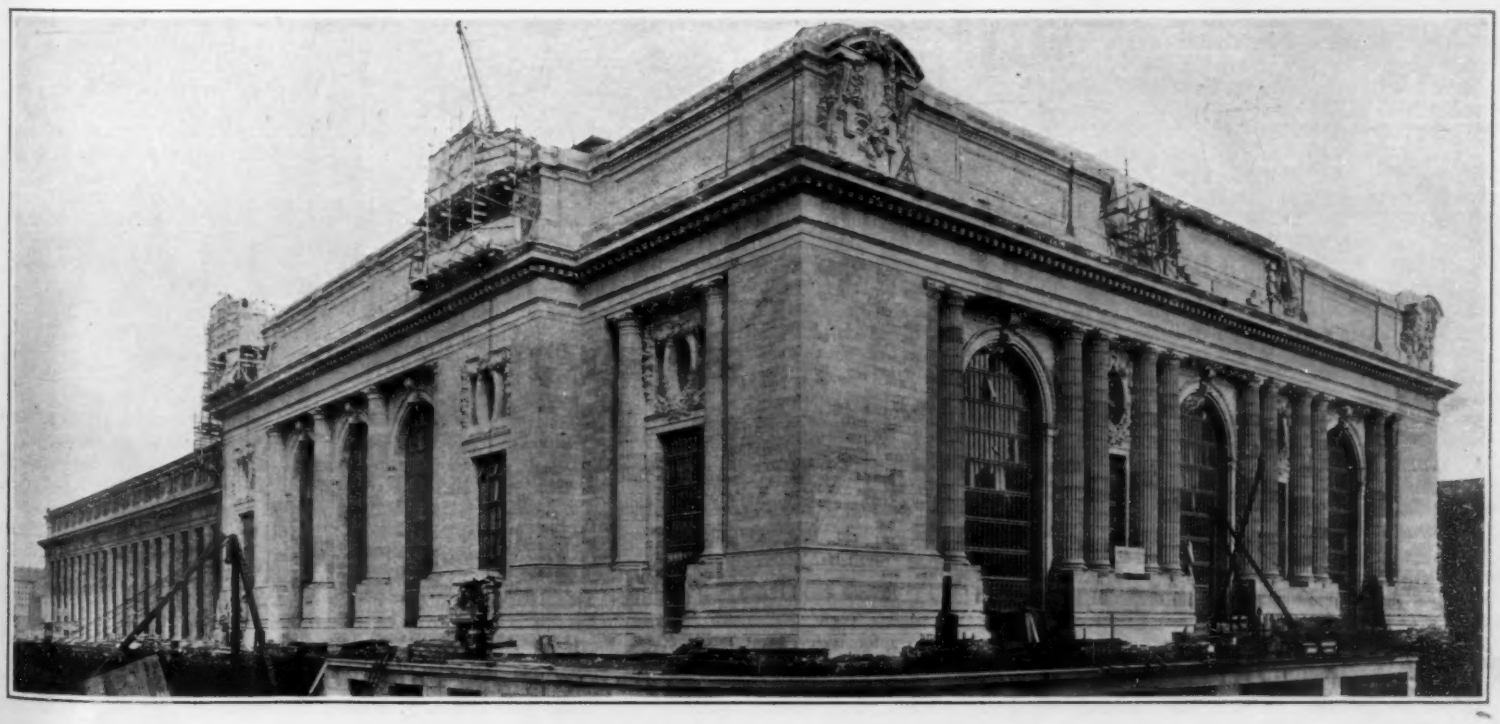
VOLUME CVII. NUMBER 23.

NEW YORK, DECEMBER 7, 1912.

15 CENTS A COPY
$3.00 A YEAR



The terminal yard and buildings, showing the express level, with Park Avenue and the cross streets restored to city use, and blocks available for erection of business buildings.



The Grand Central Terminal Building—a fine instance of appropriate architectural design.

A MONUMENTAL GATEWAY TO A GREAT CITY.—[See page 484.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, DECEMBER 7, 1912

Published by Munn & Co., Incorporated. Charles Allen Munn, President
Frederick Converse Beach, Secretary and Treasurer
all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Subscription Rates

Subscription one year $3.00
Postage prepaid in United States and possessions
Mexico, Cuba, and Panama
Subscriptions for Foreign Countries, one year, postage prepaid. 4.50
Subscriptions for Canada, one year, postage prepaid. 3.75

The Scientific American Publications

Scientific American (established 1845) . . . . . per year, $3.00
Scientific American Supplement (established 1876) . " 5.00
American Homes and Gardens . . . . . " 5.00
The combined subscription rates and rates to foreign countries including Canada, will be furnished upon application.

Remit by postal or express money order, bank draft or check

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Gratifying Conditions in the Navy

A CAREFUL reading of the annual report of the Secretary of the Navy will satisfy every impartial mind that things are going well in this important department. This journal has watched the development of Mr. Meyer's administration with a critical but always friendly eye; and although, at the outset of his control, we felt called upon to criticise certain of the changes which he introduced, we are frank to admit that the results achieved during the past four years, entitle his administration to be considered one of the most successful in the history of the department. Altogether pardonable is the evident pride with which, in this report, Mr. Meyer refers to the mobilization of the Atlantic Fleet, which took place in the North River, New York, during the autumn of the present year. The gathering together in orderly review and at so short notice of a fleet of 123 ships aggregating 720,480 tons, tells the story of preparedness and efficiency. We trust that this review, because of its powerful educative and stimulating effect upon the people of the United States, will become an annual institution.

The Secretary opens his report with a plea for making permanent by legislation his system of naval aides, whose duties are to advise the Secretary on complex questions calling for technical knowledge. Three years' experience convinces Mr. Meyer that the efficient administration of the Navy cannot be accomplished by a Secretary, unless he is assisted by a board or council made up of technical advisers. The aides meet in full council daily, and they meet the Secretary at least once a week. Congress should now give to this arrangement its legal sanction. It is recommended that in order that the Navy may get the highest possible efficiency and preparedness for war, a council of National Defense be arranged, which will in a way be a vehicle between the Navy Department and Congress. It is suggested that the council be made up of two cabinet officers, four senators, four congressmen, two army officers and two navy officers.

The preparedness of the fleet as regards repairs and upkeep has been maintained at a most satisfactory standard; and the ships have been generally in a condition during the year to respond to the many calls that have been made upon them. This has been due to the development of a spirit of self-dependence, every ship being made self-sustaining as far as possible; the establishing of routine docking and repairs; the standardizing of major changes and alterations; the use of fleet auxiliaries; and improvements in yard methods. In 1912 there were 166 ships in active service or ready for service, as against twenty on the repair list—an excellent showing.

The General Board of the Navy recommends an increase of the Navy at the coming session of Congress by the addition of four battleships, two battle cruisers, sixteen destroyers, six submarines, a dry dock and a submarine testing dock, two transports, one ammunition ship and one supply ship. It is pointed out that the four battleships will simply replace four existing battleships which will be twenty years old in 1914 and must then be withdrawn. While battle-cruisers are recommended, the Board thinks that they should not be built at the expense of the battleship programme, the paramount need of the navy being for more battleships. The Navy certainly needs the transports that are asked for; we are astonished to learn that the "Prairie" and the "Buffalo," the only vessels at present available for such duty, are both over twenty years old and that "both are single-bottom ships, and entirely lacking in water-tight subdivision, having been originally designed as freighters." It is simply murderous, in view of what happened to the "Titanic," to be using as naval transports, old ships that would be doomed if they experienced a serious collision.

As regards the engineering competitions, we are glad to learn that the performance of the vessels, almost without exception, has been highly creditable both as regards speed and economy. The larger vessels, we are told, either exceed or fall slightly below their contract speed, which in view of their increasing age indicates a high state of efficiency and continued attention to detail. The new destroyers, almost without exception, duplicate and frequently exceed the speed made at the time of their delivery to the Government. In the matter of smoke prevention, oil-burning destroyers have constantly improved, and the entire fleet can now steam at high speed without any smoke whatever, a fact of which the writer has been witness when present with the torpedo fleet.

Our powder is entirely satisfactory. The fact that the nitro-cellulose powder used in our Navy is broadly similar to that which destroyed the French battleship "Liberte" need cause no uneasiness. The French methods of manufacture are greatly inferior to our own; and our regulations for stowage, inspection, etc., are comprehensive and very strictly observed. Since the adoption of the present type not one accident due to decomposition or spontaneous ignition has occurred—no other service has such a record.

The present subdivision of work in the Navy Yards into a hull division and a machinery division, we are told, has been eminently satisfactory. This is proved by the efficiency and economy with which repairs are undertaken and completed. Mr. Meyer impresses the necessity for securing a spirited co-ordination in the administration of the Navy Yards. He approves of the recommendation made by the joint Army and Navy Board, that there should be two great naval bases on the Atlantic coast, in harbors which could receive and maintain the entire fleet and its auxiliaries. In keeping with the Department's policy of concentration, the naval stations at Pensacola, New Orleans, San Juan, Culebra and Sitka have been closed.

An urgent plea is made by Mr. Meyer for the creation of the admirals and vice-admirals which are necessary for a properly administered fleet. No provision is now made for any except the lowest grade in rank, namely, that of rear-admiral; whereas the recognized grades are admiral of the fleet, admiral, vice-admiral and rear-admiral. A battle fleet should be commanded by an admiral; vice-admirals should command squadrons; rear-admirals should command divisions. We have more vessels in commission than most of the nations giving higher rank to their officers; yet when our fleet enters foreign waters, our naval officers are compelled to yield precedence to ranking officers of the smaller nations. It is not a question of our naval officers as individuals being placed in inferior positions when they meet the fleets of other nations, but rather it is that in the eyes of other nations we put ourselves in the position of an inferior.

Fixing the Price of Patented Articles

FOR the sole purpose of encouraging the arts, the Constitution of these United States grants to a patentee the right to dictate the conditions under which his invention may be manufactured, used and sold, a right which may be exercised only during the life of the patent. Extensive though his privileges may be, we have still to hear of any flagrant instance in which the patentee has abused them. Indeed, he could not if he would. The public, not being deprived of anything that it ever enjoyed before the patent was granted, would refuse to buy patented articles which may be obtained only by observing conditions too onerous and which it can well do without. Good merchandising demands that the patented article be sold at the lowest possible price in order that the widest possible public may be reached. In recent years there has been an increasing tendency on the part of manufacturers to take advantage of the constitutional right of fixing the price at which a patented article may be sold. The result has been exactly that contemplated by the framers of the Constitution—the encouragement of new industries and the general distribution among the public of new, useful and inexpensive inventions that have made commercial and domestic life more attractive than ever.

One of the provisions of the amended Oldfield Bill seeks to destroy this time-honored right of the patentee, despite testimony from the foremost manufacturers to the effect that the fixing of selling prices on patented products have redounded to the benefit both of the manufacturer and the public. The representatives of companies whose patented wares are advertised the world over at a fixed price unhesitatingly revealed their factory methods, frankly laid bare their relations to jobbers and retailers, and freely gave exact figures of manufacturing costs and retail selling prices. A careful reading of their testimony has not brought to light a single instance in which the profit made under the price-fixing system by manufacturer, jobber or retailer is exorbitant. Indeed, we have been struck with the meticulous care that has been taken to prevent overcharging. It seems to be axiomatic that the higher the price to the ultimate consumer, the fewer must be the buyers of the manufactured article. Price-fixing, therefore, is a distinct blessing; it always means a good article sold at a price so low that almost every one can afford to buy it.

Something of the old craftsman's pride in the quality of his work seems to enter into the making of patented articles—at least that impression is left by the testimony of a dozen able manufacturers. Pains are taken to select only sound raw material; the workmanship must be the best; the package must be substantial, neat, and inviting.

The psychological effect of such good manufacturing principles and sound selling methods is inestimable. Confidence is inspired in the manufacturer and in the patented article itself. Hardly has this result been obtained, at the cost of years of effort and perhaps millions in money, when the parasite appears—the dealer who contributes nothing to an art and who battens on the energy of others. In his catalogues and advertisements he announces the sale of patented articles, made popular by much advertising, at prices less than those fixed by the manufacturer. He violates the restrictions imposed upon him, although he knows that ultimately he will be brought to book by legal proceedings. The psychological effect of his trickery is just as marked as that produced by good manufacturing and selling methods. If this patented thing, sold elsewhere for never less than three dollars, can be bought for two dollars and sixty-eight cents, does it not follow that all the other less familiar unpatented articles listed in the catalogue or advertisement can also be bought at prices lower than those charged ordinarily? Only by making the experiment does the purchaser discover that his reasoning is wrong; that he has been duped; that he has been made to pay an extortionate profit for a poorly made unpatented thing, because the patented goods of standard quality were sold below the standard price. Is it any wonder that the small retailer will refuse to deal in patented articles, the price of which has been fixed, if a larger dealer, who can afford to lose money on one patented sewing machine, for the purpose of making a profit on a thousand unpatented tables, chairs, flower pots and hats, is permitted to undersell him? Is it any wonder that for the retailer's sake and for the sake of the public, and consequently for their own sakes, manufacturers enforce their price restrictions under the patent law?

It may be, as some contend, that the framers of the Constitution never contemplated the extension of a patentee's rights so far that he can follow his article into the hands of the ultimate consumer. But it may also be contended with more force that the framers of the Constitution never contemplated the restriction of a business that is based primarily on the confidence of the public in a patentee and in the thing that he has invented.

High Speed and Good Rails

IN view of the present unsatisfactory condition of the rail question in America, the average rail which is being placed in our tracks not being able to stand up with any certainty under heavy, fast traffic, the recent decision of the New York Central and the Pennsylvania Railroads to reduce the speed of their eighteen-hour trains to Chicago is commendable. At the same time, it is a step backward. Time is becoming so increasingly valuable in the industrial and commercial world that the demand of the public for high speed, both on sea and land, is justified. Great credit was given to these two railroads when they instituted the eighteen-hour schedule from New York to Chicago; and had the rail manufacturers kept pace with the progress of the railroads, it would not now be necessary to reduce the running time of these two famous trains.

This reduction in train speed, following the recent recommendation of the governmental authorities, will have the good effect of emphasizing the urgent need which exists for the manufacture of absolutely sound rails. That such rails can be produced is proved by the fact that they are now being rolled and are giving satisfactory service under heavy fast traffic in Europe. Both in England and in Germany it has been found that by giving careful attention to the composition of steel and the method of casting it into ingots, it is possible practically to eliminate both segregations and piping. The processes, it is true, call for some slowing up of the manufacture; and this was to be expected. Their introduction would meet certainly with some opposition in the United States, where our steel manufacturers have bent every effort to increasing the output, too often at the expense of quality and general reliability.

Engineering

Egypt's Debt to the Engineer.—The Assouan dam and other irrigation works in Egypt have cost about $53,000,000; but the increase in the value of land in middle and lower Egypt and the Fayum provinces has been from $955,000,000 to $2,440,000,000. The total rent of this land has risen from $82,000,000 to $190,000,000. This is what the engineer has done for Egypt in less than two decades.

Large Austrian Floating Drydock.—The Austrian navy recently built a floating dock for the use of its new dreadnought battleships which can lift a vessel of 22,500 (long) tons. It consists of a pontoon body 541 feet in length and 17 feet high. At each side of the pontoon is a lateral caisson or wall 440 feet long, 11 feet wide and 63 feet high. The pontoon has 50 water compartments which the pumps can discharge in 4 hours. The dock carries a 180 horse-power compound engine and four 2.5-ton cranes.

One Thousand Foot Piers for New York.—The Board of Estimate of this city urges the immediate construction of eight new piers one thousand feet in length between Forty-second Street and Sixty-ninth Street, on the North River. It is proposed to keep within the present pierhead line, and obtain the necessary length by excavating back, inshore, to a distance approximately equal to the width of Twelfth Street. The waterfront in this district is at present given over to piers, the business of whose owners or lessees could be better accommodated at other points on the Manhattan shore line. The mayor of New York would go even further in providing for future development, by building the piers 1,200 feet in length.

Docks and Coaling Plants at Panama.—The plan of Col. Goethals for making Panama a point of supply of coal, oil, etc., for shipping is one of the best collateral features of the whole scheme. Several piers one thousand feet long will be built at Balboa on the Pacific side. Here also will be a drydock with a usable length of a thousand feet and depth of thirty-five feet, and a coaling plant storing and handling one hundred thousand tons of coal. Repair shops will be constructed which will handle large jobs of repair and refitting. At Cristobal on the Atlantic will be constructed several piers one thousand feet in length and a large coal storage plant, capable of handling and storing from 200,000 to 300,000 tons of coal.

The Caucasus Tunnel.—The administration of the Russian railways is seriously occupied with the project of a tunnel of gigantic proportions through the Caucasus Mountains. This tunnel, the largest in the world, would have a length of nearly 16½ miles, and it has been already the object of a conference between Russian and foreign engineers, who have found: 1. That the geological structure of the mountain does not present any great obstacles. 2. That during the borings of the galleries no such difficulties will be encountered as during the borings of the Simplon tunnel. 3. That the temperature can be maintained at about 77 deg. Fahr. 4. That the elevation of the tunnel being between 4,300 and 4,650 feet, there is no danger of encountering subterranean water courses. 5. The work will take about eight years. This great undertaking would insure a direct connection between Vladikavkees and Tiflis.

Naos Island Breakwater at Panama.—The piling for the great dike which is being built on the easterly side of the Panama entrance on the Pacific, extending from the main land for three and one third miles, is nearing completion, and before long all of the rockwork will have been filled in. There has been much settlement necessitating large additional dumping of rock. The total vertical settlement in one section during the period July 1st, 1911, to June 30th, 1912, aggregated 125 feet, and in some cases the movement of the mud has carried the trestle laterally as much as 300 feet, but the fill is now stable, and a carriage way will be built along its surface giving access to Naos Island. This dike prevents the carrying of sediment by the current which sets across the axis of the canal entrance from the east.

Rebuilding an Underground Canal.—About $2,000,000 is to be expended in rebuilding the underground section of the canal leading from the Marne to the Rhine. The Mauvages tunnel, as it is called, is 3 miles long; it was built about 60 years ago and carries the canal under elevated ground at this point. The old masonry lining proveing insufficient, a new and heavier lining of beton is being put in throughout the whole length. Navigation may not be stopped and the work is carried out on the Fougerolle system, which allows of working for short periods at a time. The process consists of dividing the tunnel into 600-foot sections, each section being pumped dry in one hour's time to allow work to be carried on for one day, when the canal is again flooded to give passage to the boats. The pumping is done from two boat-like caissons, one at each end of the section. The tunnel is approximately elliptical with a 2-foot 8-inch beton lining, the inside width of the section being about 28 feet.

Electricity

Electric Furnaces for Sheffield Steel Works.—A new steel works is being built by the Stobie Steel Company of Sheffield, England, in which only electrical steel melting furnaces will be installed. At first the installation will comprise a 15-ton, 3-phase furnace, a 5-ton, 2-phase furnace for special steel, and small melting furnace for alloys. This will be the first all-electric steel works in Great Britain.

Cost of Meals in an Electrical Restaurant.—An English electrical paper gives an interesting note of the prices charged in a popular London restaurant employing electric cooking devices. The prices are said to be far less than those encountered in the West End restaurants, while the cooking is beyond reproach. A simple lunch of soup, a chop with potato chips, mineral water and bread and concluding with a sweet and coffee, cost one shilling ninepence.

The Cable Not to be Supplanted by Wireless.—An announcement recently made by the directors of an ocean cable company once more emphasizes the fact that no detrimental effect whatever has been experienced by the rapid expansion of wireless telegraph communication. Just as in the familiar case of a new rapid transit system in a large city finding its own new business without taking from the traffic on existing means of transportation, so the cable companies are finding that there is ample room for both the old and the new systems in the increasing demand for transoceanic telegraphy.

Electric-light Carbons from Tar.—Carbons of high grade are now to be obtained from tar, according to a process invented by a Swedish firm. The powdered carbon will be pressed to form electric-light carbons or larger sizes for electro-chemical work. The method is based on the fact that finely-divided carbon makes up a large percentage of the composition of tar and is what gives the black color, this being due to the carbon particles suspended in an otherwise dense and transparent yellowish-brown liquid. A process is used for separating the carbon from the liquid, and it can then be molded into any desired shape.

Electric Instead of Compressed-air Cars.—Parisians will not regret the disappearance of the compressed-air tramway cars which have been running for so many years past, as these are now to be replaced by electric cars. The problem of surface traction in the city was a difficult one in the early days, owing to the fact that the trolley is practically prohibited within the city limits, and this led to the use of compressed-air cars of the double-deck type with trailers, upon quite a number of the principal lines. Now that the Thomson-Houston underground conduit has proved such a success, it is to be adopted extensively and the compressed-air cars are likely to disappear. The work of laying the conduits for the electric lines is now going on in many of the principal streets.

Blue Gelatin Copper.—Bancroft's method of ornamenting copper, nickel, brass or platinum is to make the metal the cathode in 325 cubic centimeters of a one per cent solution of copper acetate containing one gramme of gelatin and electrolyzing for five minutes with a current density of nearly one half ampere to one hundred square centimeters of cathode surface. Immersion in a five per cent solution of copper acetate after electrolysis "develops" the deposit. If the plate is dipped in hydrazine hydrate before developing in the copper acetate the action is hastened. A variety of colors may be given the film, but peacock blue is the most beautiful. At temperatures above 50 deg. Cent. (122 deg. Fahr.) a red color appears and a short electrolysis between 55 deg. Cent. and 60 deg. Cent. with a lower amperage yields an iridescent gold film. The final touch is the application of a coat of lacquer.

Explosion Proof Motors.—The United States Bureau of Mines, following an investigation having for its purpose to ascertain the methods of lessening the risks attending the use of electricity in mining, refers to the term "explosion proof" as applied to an electric motor as defining a motor inclosed by a casing so constructed that an explosion of a mixture of air and mine gas (methane) within the casing will not ignite a mixture of the same gas surrounding the motor. It appears that there are two classes of motors so constructed; one a totally inclosed class built strong enough to withstand high internal pressures and another provided with relief openings or valves to relieve the pressure of an explosion within the motor casing and to cool any products of combustion discharged through the valves. A satisfactory motor of the first class is much more expensive to build than an equally safe motor of the other class, and attempts to make motors explosion proof have for such reason been confined chiefly to motors of the second class. The principle of the Davy safety lamp has been the basis of most of the protective devices, the application of the principle consisting in causing the discharged gases to pass over or through metallic plates or screens which by conduction remove the heat from the gases. In some types the cooling effect of expansion is also utilized.

Science

Dr. Carrel Sails for the Nobel Prize.—On the 26th of November Dr. Alexis Carrel sailed for Europe in order to receive the Nobel Prize.

A Memorial to W. T. Stead is to be provided by his countrymen, and a large and influential association has been formed in London to promote the enterprise. The memorial will probably take the form of hostels for women, in recognition of the fact that Stead was a knight-errant in the cause of womanhood. It is also proposed to erect a monument to the dead publicist on the Thames Embankment.

The New Deutsches Museum of Munich.—The Industrial Museum of Munich, which is one of the most important institutions of the kind in Germany, is taking measures to increase the efficiency of the establishment and especially to add to the industrial collections in the way of models or specimens. To this end it decided to send a commission to the United States in order to examine the industrial field and visit the museums. The collections are at present installed in temporary quarters, but a handsome building is in construction for the purpose and it will be inaugurated in 1915.

A Monument to Berthelot.—A monument is to be erected at Paris to the celebrated chemist Berthelot, recently deceased, and the statue is now being finished by the sculptor Saint-Marceaux. It will be erected close to the College de France which forms part of the University buildings, and not far from the laboratory where he formerly worked. The statue is an upright figure, and the base contains a series of appropriate bas reliefs, also a list of his discoveries and works, with the inscription, "Marcellin Berthelot, 1827–1907. Monument erected by international subscription."

Is Naphthalene a Good Insecticide?—The question as to whether naphthalene is to be recommended as an insecticide is discussed by the French scientists Lecaillon and Audige. This substance is commonly sold in the shape of small balls and is used in households, especially for preserving furs or various fabrics, but it appears that after being a favorite its use is falling off. They find that the toxic effect only takes place in a confined atmosphere and its action is slow. Furs or garments should be thus preserved in as tight receptacles as possible. It can also be used in horticulture in greenhouses for protecting against aphides and the like, but it appears to have no effect upon earthworms.

The Science of Detecting Crime.—M. Bertillon, the well-known chief of the Paris anthropometric service, is engaged in giving a course of technical and practical police instruction to the new criminal brigade composed of 200 picked men of the police force. The courses which have now been organized at headquarters are likely to be of value in training the men, and instruction is given in different branches by several specialists. The part which M. Bertillon has in charge includes conferences upon anthropometric service for identifying criminals, in which photographic views play an important part. Instruction courses of this kind also exist in other countries of Europe.

The Return of the Sea Serpent.—Capt. Ruser, who is now commander of the "Kaiserin Auguste Victoria" and has been designated to command the colossal "Imperator," is one of the best-known seamen on the Atlantic, and respectful attention will be accorded to the statement in his log of July 5th, 1912 (as quoted in *Annalen der Hydrographie*) that at 6:30 A. M. of that day he, as well as his first officer and an Elbe pilot who was on board, saw a sea serpent in the water close alongside the ship, then off Prawle Point. The creature was 20 feet long, and appeared to be engaged in combat with some other marine animal, as it was lashing the sea violently with its tail. Its color was grayish blue on the back and whitish under the belly. The body was between a foot and a foot and a half in diameter. Capt. Ruser says that the whole length of the animal was visible, and there could be no mistake about its reptilian form.

Volcanic Dust in the Atmosphere.—From many points in America and Europe come reports of an unusual turbidity of the atmosphere, which began early last summer and still continues. This is manifested in a marked diminution of the intensity of solar radiation, as measured with the pyrheliometer, abnormal displacement of the neutral points of atmospheric polarization, a hazy appearance of the sky, and the presence of Bishop's ring around the sun. From Dublin Sir John Moore wrote last August: "The sky is constantly covered with a thin film of uniform cloud in which no halos develop, and through which the sun, moon, and stars shine with a subdued, sickly brightness." Observers in Russia, Switzerland, Sweden and Germany, as well as America, report an unusual lack of blueness in the sky. There seems to be every reason to attribute these phenomena to the presence in the upper atmosphere of an immense pall of dust arising from the explosive eruption of Katmai volcano, in Alaska, last June. Similar effects were observed after the eruptions of Krakatoa and Mont Pelé, and in those cases lasted for some years.

Street Paving With a Motor Truck

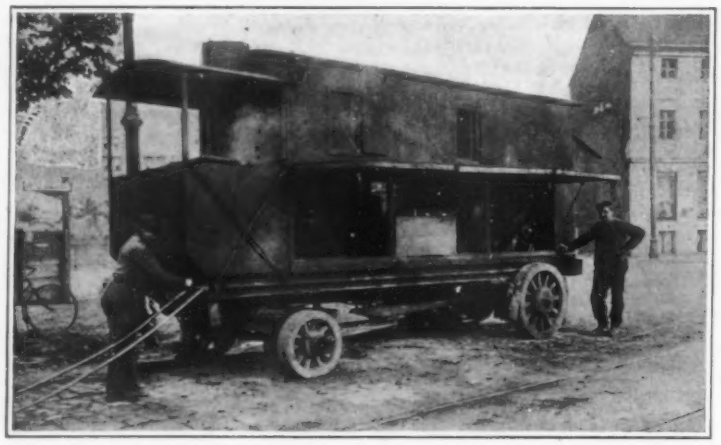
By Theodore M. R. von Kéler

AN extraordinary vehicle recently appeared on the streets of Berlin, Germany. Resembling a railroad freight car, it rumbled along the pavements on wooden wheels with wide steel tires, and few of the passers-by could imagine for what purpose it was intended. It stopped at a corner where paving was being done, and there it resolved itself into a combination motor truck and pneumatic tamping machine, specially designed for street paving with Belgian blocks.

The motor is an 18 horse-power benzol motor, which drives the truck itself and also a compressed air apparatus for the use of the pneumatic tamping tools. Instead of lifting and dropping the heavy old mauls by hand at the rate of about fifteen a minute, the workmen place the pneumatic tampers on the stone and the motor "does the rest." It delivers 90 blows per minute under pressure of six atmospheres, and enables one man to tamp 130 square yards in a day of eight hours. By hand the same man could only accomplish about 30 square yards. The use of the motor-driven apparatus has also had an unexpected influence on the wages of the workmen. While formerly it was necessary to choose men of superior physique and great endurance and to pay them high wages, it is now possible to use any ordinarily-built man to handle the pneumatic machines. The work is comparatively easy, and naturally the wages paid are smaller, despite the fact that each accomplishes four times the amount of work that the more powerful man formerly could perform.

The entire truck is surrounded by a heavy wooden "box" which can be locked and left at the place of street repairs, without necessitating the employment of a watchman to keep guard over it. The compressor can supply air to three to eight men, while the truck pulls a trailer filled with stone blocks, sand and other materials needed in the work.

A battery of pneumatic tampers at work.



The power plant for the pneumatic tampers.

A Freak Racing Car

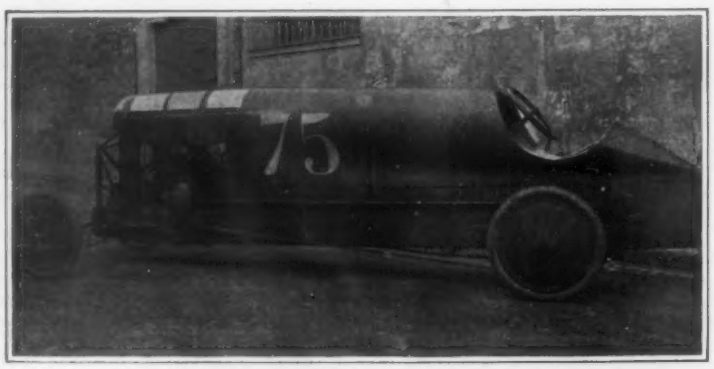
By G. M. Sommers

WHILE the "Bedelia" racing car, shown in the accompanying picture, did not win the famous annual Gaillon hill climb, in Northern France, it was easily the most talked-of machine seen in that event. With its extremely narrow, elongated shape it made an impression not easily forgotten.

The "Bedelia"—that is, the ordinary commercial "Bedelia"—is queer enough, but the racing variety is nothing more nor less than a freak. As will be seen from the photograph, it is propelled by a two-cylinder V-shaped motor, which is cooled by air without the assistance of a fan. Power from the motor is transmitted to the rear wheels by means of a leather V-belt, running along the left side of the car. The wheels are of the disk variety—that is to say, the wire wheels are protected by thin sheets of metal against injury, affording at the same time less resistance to the wind.

The huge gasoline tank is carried on top of the framework surrounding the motor, while the space immediately behind the power-plant, covered in the illustration by the numeral 75, is absolutely empty. The driver sits far back, almost directly over the rear wheels, and controls the front wheels by means of wire cables, carried within the long hood, but issuing just in front of the motor. The rear wheels and axle carry the body by means of leaf springs of the more conventional type, although the method of suspending the load is somewhat unusual. The front wheels are set on a tubular axle which supports the weight of the motor and gasoline tank on a spiral spring not unlike the so-called spring-frame arrangement of some motorcycles.

The ordinary "Bedelia," of which a good many are at present running on the streets of Paris, is a type of car which is absolutely unknown in this country. It is a tandem-seated contrivance, in which the passenger sits in front of the driver. As far as the system of motor propulsion is concerned, it is the same as in the racing car: a two-cylinder V-motor, acting on the rear wheels by means of a V-shaped leather belt. It is extremely light; so light, in fact, that two men can with ease lift the whole machine clear of the ground. It is fitted with Hutchinson non-skid tires and is manufactured by R. Boupreau & H. Devaux, Paris. The ordinary "Bedelia" develops about 6 to 8 horse-power, and is capable of a speed of thirty miles an hour. The special racing model develops about 12 horse-power, and can attain a speed of a mile in a minute.



The "Bedelia," a freak racing car.

Anti-malarial Work

THOUGH there has been much anti-malarial prophylaxis in the United States since *Anopheles* has been demonstrated to be the carrier of the plasmodium, this disease is yet far from being eliminated, especially in the South. The facts fundamental to malaria extinction are well known; lack of success in any community must mean that the *modus operandi* has been inadequate and imperfect, the fault generally being that details have been neglected or ridiculed as too trivial for attention. A succinct statement of the procedures adopted against malaria in the Canal Zone by Colonel Gorgas and his staff should not therefore be amiss.[1] It is well known that conditions for anopheles breeding in the Panamanian Isthmus are ideal all the year round; nowhere else on the globe could this mosquito flourish so luxuriantly, were not its breeding frustrated by sanitary science. When malaria can be practically extinguished in such a region, the same thing can be done pretty much anywhere else. Gorgas's measures in the order of their importance are: 1. The habitat of anopheles during the larval stage is destroyed within a hundred yards of dwellings. The larvæ of this mosquito live only as a rule in clear, fresh water which is plentifully supplied with grass and algæ. Tile drains are the most effective and economical; once put down they require no more attention; no water being exposed to the surface, there is no breeding place left for mosquitoes; by means of a horse mower or scythe the grass over the drain can be cut. Failing tiles, an open concreted ditch may be put down; but the first cost here is nearly as much as for tiling, and the concrete ditch must constantly be kept clear of obstructions, in which breeding pools may form. Open ditches are the least effective and most expensive. 2. All protection for the adult mosquito must be destroyed. The adult is weak on the wing, not generally flying far and needing plenty of grass and brush for protection against the wind. Brush and grass are therefore cleared for a hundred yards around dwellings; where the locality is to be occupied for a year or more, it is best graded and grassed, the latter kept well mowed. There is no objection to a little shrubbery or a few trees about a dwelling. 3. All habitations are screened, but effectively. Screens as ordinarily put up without expert supervision are of little use. Good wire should last three years; there is plenty of screening on the market that will not last six months. 4. When breeding places cannot be destroyed by draining, larvæ are destroyed by means of crude petroleum, Phinotas oil and sulphate of copper. The first of these is used in temporary pools, caused by bad construction, or at temporary camps where it would not be economical to drain, and wherever drainage is impracticable; the last two are used for killing the larvæ in the algæ and grass along the edge of a lake, a stream or a swamp.

For those interested in the health of industrial camps, Gorgas makes some exceedingly pregnant observations: In and about the Canal Zone fifty thousand laborers and their families are scattered over five hundred square miles, though they are principally collected in some forty camps and villages along the line of the canal; these five hundred square miles are divided into seventeen districts, all under a chief sanitary inspector, with the necessary clerical force and three assistants, of whom one is especially wise in mosquito lore, the second expert in ditching, draining, oiling, etc., the third a competent executive. Each one of the seventeen districts has its district inspector, who has from forty to fifty laborers to do the necessary draining, carpenters to keep the screens in repair, and one or two quinine dispensers, who go about urging though not compelling employees to take three-grain pills as prophylactic doses. The district inspector reports daily to the central office the number of malaria cases and the number of employees among whom the patients live. Each inspector is held responsible for any excess of malaria in his district. If the admission rate for malaria during the week rises above one and one half per cent something is considered wrong, and the assistants to the chief sanitary inspector are sent to discover the cause. These assistants are moreover kept constantly busy over the work, advising and instructing the district inspectors. Herein Gorgas finds the gist of the whole situation: the district inspector and the working force having usually no special knowledge of mosquito life and habits, must be constantly under the surveillance and supreme control of the sanitary officer and his trained scientific assistants, who should then be held responsible.

[1] Gorgas, W. C., the Sanitary Organization of the Isthmian Canal, as it Bears Upon Anti-malarial Work. *Jour. Assn. Military Surgeons of the U. S.*

Natural Coke and Volcanic Graphite

COKE is made in nature as well as in brick ovens. When hot volcanic material comes into contact with a coal bed, under the proper conditions, it makes very good coke indeed, although not in sufficiently large deposits to be commercially valuable. Such natural coke is often found by the geologist or the prospector.

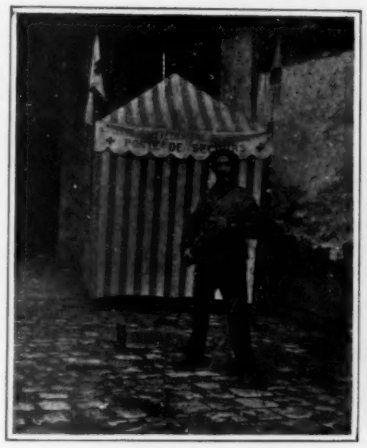
Graphite is also manufactured out of coal by volcanic heating, and in this case the product is commercially important. Graphite is nearly pure carbon. In geologic examinations of the deposits of the Raton coal fields in New Mexico, Geologist Lee found some excellent examples where coal had been metamorphosed into graphite by comparatively recent instrusions of hot volcanic rock, the combustion of the coal being prevented by the absence of air. Man is now manufacturing graphite as well as coke out of coal.

A New Gun for Throwing Bombs and Life Lines

By Jacques Boyer

THE portable cannon recently invented by M. Mathiot is capable of throwing objects of considerable size and small density to a moderate distance, but without great precision, which can be obtained only with a rifled gun and small, heavy projectiles. The Mathiot gun, however, was designed for uses in which great accuracy of fire is not required. Chief among these uses is the throwing of bombs which emit suffocating gases into the haunts of dangerous criminals, in order to capture the malefactors without risking the lives of policemen. It may also be employed in war for throwing light bombs, in shipwreck for throwing life lines, and in conflagrations for scattering fire-extinguishing powders and cutting off the advance of the flames.

Fighting fire with the Mathiot gun.



Throwing a lifeline with the new Mathiot Gun.

The gun in action behind a specially designed shield.

The accompanying drawing shows the gun in section and in outline, and also an enlarged section of the breech. The barrel *a*, of large bore and varying in length from 28 to 43 inches, in different models, is securely attached to the breech block *c* by means of the groove *d*. The breech block contains a hemispherical cavity, with a cylindrical extension into which can be inserted the tube *e*, containing a central-fire blank cartridge *f*, of the usual type. The cartridge is exploded by striking with the hand the flat round head *h* of the hammer *g*, and thus driving the point of the hammer against the fulminating cap. The shaft of the hammer is a square rod which moves with slight friction through the breech stopper *i*. The outer end of this stopper carries a screw thread fitting a corresponding thread in the end of the breech. The stopper is screwed into the breech until the rim of the hollow inner end of the stopper presses firmly upon the cartridge. This operation is effected by timing the head *h;* as the stopper necessarily rotates with the square rod *g* after firing, the stopper is unscrewed and the gun is inclined until the tube *e* slides out. The spent cartridge in the tube is then replaced by a fresh one, and the tube and stopper are again inserted in the breech. The hemispherical cavity in the breech block allows the gases of combustion to expand before they act on the wad *k*, which is interposed between the cartridge and the bomb or other projectile.

The gun is suspended from the body of the gunner by a novel and ingenious harness, designed to minimize and distribute the shock of the recoil. The breech of the gun is attached by the spring *u* to the girdle *s* (see drawing) and additional support is given by straps passing over the shoulders and descending to the ground, where they terminate in loops in which the feet are inserted.

In the first model adopted by the inventor the range was found by making trial shots with an attached spring gun *l* and noting the position which the air

Concluded on page 497.)

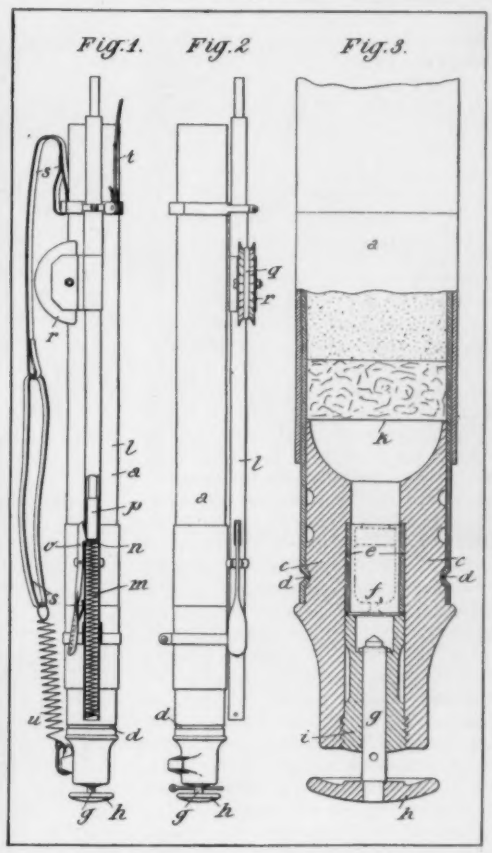


Fig. 1.—Section of the gun. Fig. 2.—Front view. Fig. 3.—Section of breech.

Liquefying and Bottling Illuminating Gas

By Frank P. Peterson

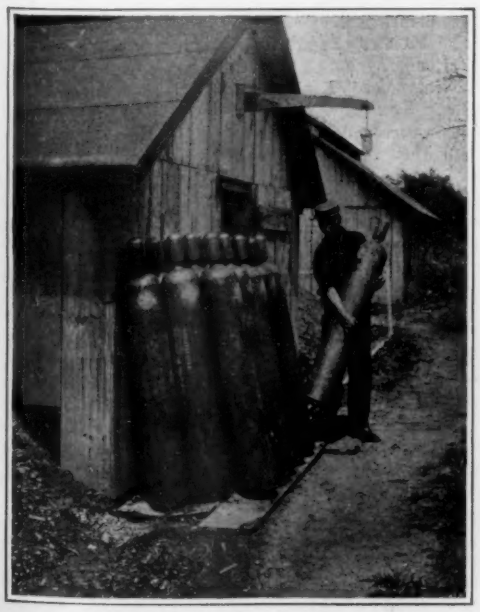
GASES are the most fascinating of materials with which we have to deal. They represent matter in its final form, its permanent form, if it have such, and permanency approaches nearest to perfection of matter. In our past dealings with matter we have looked upon gases as the evidence of dissolution, decay, disruption, and it is only recently that we turn our minds to the restoration or reconstructive uses to which we may apply our knowledge of gases and their physical adaptations.

Since the adaptation of gas to the supreme comfort of light and heat, until recently, we were willing to let it go at that. If we needed gas at any place, we compounded it, like nitroglycerine, and used it, where required, because of its difficulty of transportation. And because of the similitude some people are likely to confound also the dangerous qualities of gas with those of the deadly explosive. Such is far from a true conception, however, and the deterring influence has been cost, and not danger, of transportation.

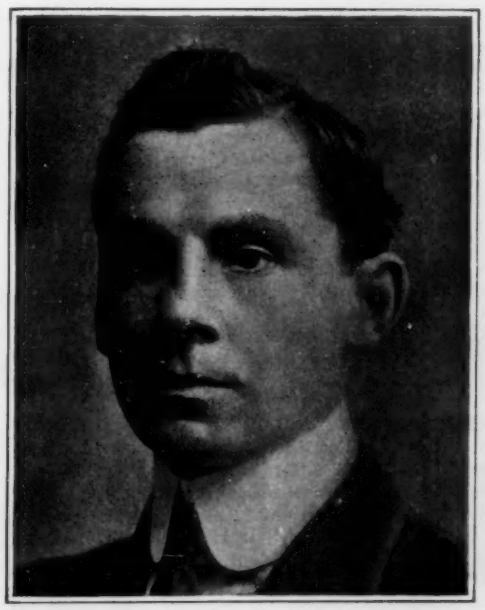
Every material thing has, or is capable of having, three physical forms, the solid, the liquid, the gaseous.

Transportation, as a simplified problem, deals with them in the inverse order as named; and it is not uninteresting to note that we transport the first two through the dynamic forces exerted by the third, and we measure now by months the young art of adapting the gaseous form to such decreased bulk as permits us to handle, transport and deliver it as we do its component solid or liquid equivalent.

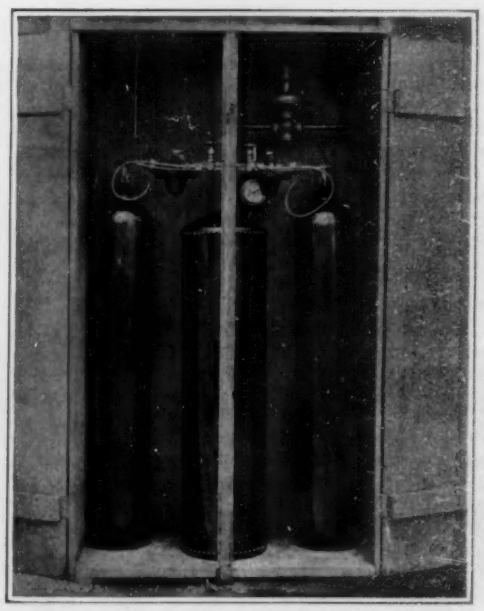
The coming of railway carriages of house proportions probably created the first extensive real need of



Bottles filled with liquefied gas and ready for transportation to the consumer, to any distance and by any means, with greater safety than ordinary gasoline or kerosene in cans, or acetylene or carbide.



Dr. Walter O. Snelling, inventor of a new compressed gas retained in liquid form in strong steel bottles. It revaporizes perfectly, even at a temperature of 40 degrees below zero.



Service cabinet containing enough gas to last a small family two months. An empty bottle is replaced by a full one by loosening the nut indicated by the arrow at the left.

a transportable gas. The liability to wreckage and the spreading disaster of lamp oil on fire made evident the direct necessity for departure from lamp oil. Then came Pintsch with compressed gas. And thereby was demonstrated, first, the safety and, second, the possible economy of transporting gas. The greatest credit which is due to Pintsch is that he dismissed from the minds of the public the hobgoblin of fear of a compressed gas. After that came the transportation of vast volumes of natural gas compressed into such small bulk that it can find its way through long reaches of pipe and expand to its normal bulk, when finally released and consumed. Pintsch could crowd somewhere in the neighborhood of 250 cubic feet of his gas into a tank having a volume capacity of around 13 cubic feet. If the big gas main leading out of Hastings, W. Va., can comfortably deliver 2,400 feet of gas a minute at such pressures as are required at the burners, it can just as readily pass 57,000 cubic feet per minute along at the pressure it sustains of 350 pounds per square inch.

The volume of a gas, the temperature being always the same, is in inverse ratio to the pressure applied to compress it, the unit of pressure being 14.7 pounds per square inch, or one atmosphere, and this rule holds good just so long as the gas retains its gaseous character. Had Pintsch gone on in the application of greater pressure to his gas he would presently have secured it, or a goodly portion of it, in a liquid form. There would have been some waste, however, in a portion which would not liquefy and also in a portion which would not regasify. So Pintsch, studying economy, stopped where he thought the best results were obtained. Blau and Linus Wolfe came later. Going at the work on a much larger scale than Pintsch's early developments permitted, and with Pintsch's experience and accomplishments on record before them, these men were able to adapt the wastes to the form of useful energy to carry on the process, thereby forming a closed circuit in the operation and claiming much greater economy. It is a pity that Pintsch stopped where he did, for the claims of Blau and Wolfe to greater economy are justified only in the lesser cost of transportation of a liquid as against a gaseous form of fuel. Even this claim is open to grave question, notwithstanding it is accepted by some of the foremost economists, if the great captains of industry may be so classed.

At any rate, Blau and Wolfe reached the goal of transforming gas fuel to liquid form. They were compelled to use much greater pressures than Pintsch. Their efforts are rewarded with world-wide appreciation and approval. These pioneers made their gas from oil. They recognized only the safe source of large supply that oil seemed to insure.

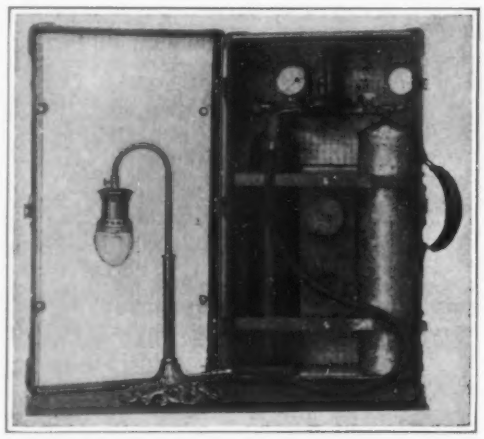
Why, we may ask, do not the transporting companies that handle natural gas resort to the means of Blau and Wolfe in the handling of their gas? The answer is twofold. It is, first, impracticable, because of the enormous pressure involved and the weight and strength of pipe thereby required, and finally impossible because of the abnormally low temperature demanded by natural gas to maintain it in the liquid form. They follow, therefore, consistently, Pintsch's compromise and compress the gas only to the reasonable and safe limits of strength of comparatively cheap, thin walled steel tubing.

Not until the compressing of natural gases from oil wells for gasoline justified a most extensive study of their composition, was the most recent phase of gas and adaptation to liquid form suggested. This extensive investigation was mentioned in a former article describing that interesting modern petroleum development. It set forth the following facts: Petroleum gases are of widely varying general composition. They may be, and now are, classified in two great groups, dry gas and wet gas. The latter term is misleading when understood to have reference to water, though some gases do carry suspended small percentages of water moisture. The wet gases may be separated into different compounds, both liquid and gaseous. The dry gases cannot be liquefied readily, and must, under all commercial conditions, retain their gaseous nature. No sooner is the fact recognized that these gases exist in sufficient quantity to justify their salvage and distribution to human comfort than we find the genius and the man of science ready to devote his time to it. Walter O. Snelling, doctor of physics, of science and of chemistry, cast aside the obstacles and they fell, in the final perfection of the system of treatment to produce the new liquid gas, and he applied one of the most beautiful theories imaginable.

Now every gas possesses a peculiar trait called its critical temperature, and it also has a corresponding critical pressure. This pressure matter is immaterial in some sense because we can usually acquire it without great effort. Beginning with the most prevalent of the components of complex natural gases, such as here considered, we take up methane. To liquefy it, no matter what the pressure, we must reduce its temperature to about 115 degrees below zero Fahr. Eight hundred and twenty-five pounds per square inch will serve when we have reached this frosty state to reduce methane to liquid. After we have accomplished the result, and as soon as the temperature starts back to normal, the pressure begins to jump up the scale. It appears then, that we will not attempt to liquefy this product on a commercial scale at least. Next let us examine ethane, the second in the compound. If we use a temperature of 95 degrees above Fahr., we may liquefy it at 678 pounds pressure per square inch. Then let us take the third, propane, in the compound. Two hundred and seventy degrees Fahr. and 660 pounds will do for its liquefaction, or any combination of lower temperature and corresponding pressure may be used. Butane (and all the above named compounds may be found in the complex gases) will yield to maximums of about 300 deg. Fahr. and 550 pounds, or correspondingly more reasonable figures.

We find Dr. Snelling's ingenious mind evolving such a chamber as will withstand any one of the above named pressures. Condensing coils, regulated in temperature to accommodate such of the compounds as are wanted in the new liquid, if need be, are set within the chamber. Now, it will be seen that, if a coil maintain a temperature in excess of that which is critical for any one of the fractions above mentioned, that fraction cannot condense upon that particular coil, but must pass on to the next which affords the requisite physical condition. Each coil is provided with its own receiver arranged to separate the liquid condensing against it and to convey it outside of the main chamber, where, by means of strong cocks, it can be drawn off. "Selective rectification" is the term applied, and it seems to exactly express the idea.

The new liquid is used to light isolated residences, boats, vehicles, to cook and heat, for brazing, metal cutting, glass blowing and as a very promising anæsthetic. It is retained in the liquid form in strong steel bottles. For absolute safety it is placed in a cabinet, outside of a housing of any kind, on the top or outside of a boat or railway car. The butane, above mentioned, will readily liquefy, if the temperature goes much below zero Fahr., and some pentane, if we do not "rectify" it out, can be liquid at 90 deg. Fahr. Now, supposing these fractions are allowed to remain in the liquid gaseous compound, they tend to go over through the piping system in their liquid form, and, upon reaching the warm temperature of the interior of a living-room, the result is irregular expansion to gaseous form, fluctuation of pressure and general defeat of the perfect results sought. That all this has been carefully anticipated is evidenced by the fact that perfect revaporization of this gas takes place at 40 degrees below zero Fahr., and the steadiness and even qualities of the lights are remarkable under every kind of condition.



The first practical demonstration of the use of the new liquefied gas was made in a suitcase, and it illuminated a room for forty hours.

No pure gas has been found which will exist in the gaseous state through the range of pressure and temperature of the new gas and give its equal in heating value.

From 2,200 to 2,400 British thermal units per cubic foot are registered for it, as against 1,800 to 1,900 for the best artificial products in liquefied form, 1,575 for acetylene gas, 1,060 for good natural gas, 650 for high-class Lowe process carburetted water gas, 550 for average coal retort gas, etc.

The pressure at which it is retained in the steel containers do not exceed 750 pounds under extreme conditions, such as exposure to hot sunshine. It is absolutely non-poisonous in the sense of blood depletion, and when diluted with any considerable amount of air is neither dangerous nor offensive to smell. Its range of explosible admixture with air is less than that for any other gas. It is put into convenient size packages and can be transported to any distance and by any means with greater safety than can ordinary gasoline or kerosene in cans, and with far greater safety than acetylene or carbide, as shock or water has absolutely no effect upon it.

And, finally, it is the cheapest known concentrated form of gaseous fuel, being about equivalent in cost to manufactured illuminating gas of the common kind at $1.25 per 1,000 cubic feet.

A Curious Gift to the City of Evansville

ON October 26th, 2161, the city of Evansville, Indiana, will be richer by $90,955,400.13—that is, if the provisions of a deed of gift of Adolph Melzer of Evansville are strictly carried out. Mr. Melzer deposited with the City National Bank of Evansville the sum of one thousand dollars to be held by the bank, its successors and assigns under the following conditions: Interest upon the sum deposited is to be credited and added to the principal at the rate of 4 per cent per annum every six months for the period of 250 years, during the whole of which period the interest shall be compounded. At the expiration of the period of 250 years, the sum will amount to $90,956,400.13. This is then to be paid over to the city of Evansville as a gift from Adolph Melzer. In commenting upon the gift the *Evansville Journal News* writes as follows:

"What will the Evansville of that time be? How large? How wealthy? Will wealth be the same inspiration for service that it is among Americans to-day?

"History has shown that many things may happen in 250 years. History has also shown that few things may happen in that length of time. There are cities on the eastern coast in this country that have been established for that length of time and have undergone comparatively few changes, apart from natural growth and a shaping of their destinies according to development of political force. In the old countries are many cities in whose histories 250 years is like only one chapter in a book, for they have existed for a thousand years or more, and many historic cities of antiquity are surviving to-day with modern atmosphere. Centuries are in their cases as the years of a man's life.

"So, while on the score of past historical comparison we should say comparatively little may happen to change the organic character of a city's existence in even so long a time as 250 years, those comparisons are not furnishing us an accurate idea to what we may expect in the future.

"It remains an open question, just what the Evansville of 2162 will be—a question for which there are as many solutions as individuals. But, at that, it is very interesting to think about."

Results of the Gordon Bennett Balloon Race

THE official result of the international balloon race for the Gordon Bennett Trophy, which started at Stuttgart on October 27th, was announced on November 23d. The balloons were placed as follows:

"Picardi," France, first, 2,191 kilometers (1,361 miles 5½ furlongs).

"Ile de France," France, second, 2,001 kilometers (1,243 miles 5 furlongs).

"Uncle Sam," United States, distance unrecorded.

"Frankfurt," Austria, 1,769 kilometers (1,100 miles).

"Zurich," Switzerland, 1,523 kilometers (946 miles 4 furlongs).

"Reichsflugverein," Germany, 1,385 kilometers (860 miles 6 furlongs).

"Minckelers," Belgium, 1,291 kilometers (802 miles 3 furlongs).

"Honeymoon," England, 1,253 kilometers (778 miles 6 furlongs).

The other balloons covered less than 745 miles each while the "Million Population," America, made only 646 kilometers (401½ miles).

The protest of John Watts of St. Louis, against the ruling out of the race of the "Dusseldorf II." was rejected by the judges committee.

Coppered Brass Decoration

A DESIGN outlined in copper on a brass plate or brass on a copper plate is very attractive. This can be obtained by covering the brass sheet with solid chloride of iron and heating a few minutes. Zinc, as is well known, displaces iron from its salts, itself passing into solution. Since brass is an alloy of copper and zinc, the treatment removes the zinc from the surface layer. Of course iron is deposited, but when the plate is washed it all comes off, leaving a copper surface.

Now melt a thin layer of paraffin over the plate and trace the outline desired in the paraffin, scratching down to the metal. Pour dilute nitric acid over the plate, and in a minute wash off and melt the paraffin. It will be found that the acid attacked the metal only where the paraffin had been scratched away. The thin copper surface layer has been eaten, exposing the brass beneath, and the design appears in brass against a copper ground.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

The Short Crossover Controversy

To the Editor of the SCIENTIFIC AMERICAN:

Referring to the crossover argument in the November 16th issue of the SCIENTIFIC AMERICAN: I am a practical as well as scientific railroad operating department official, and naturally my sympathies are with the railroad company, but your argument on the crossover makes Mr. McHenry of the New York, New Haven & Hartford Railroad look like the proverbial thirty cents. Your logic and argument show a full comprehension of the practical difficulties of railroading, show an accuracy of conception and a judgment beyond question; to this you have added a gentlemanly spirit, and your motive for the benefit of the traveling public is certainly an exalted one. Compared with this, Mr. McHenry's argument is wanting in courtesy, is wanting in accuracy. With a slow order of 15 miles per hour, Mr. McHenry must know that very few trains in every-day operation slow down to such a speed. The Pennsylvania's slow order of 35 miles per hour for crossovers is practically speaking a privilege to make 50 or 60 miles; and the traveling public, as I myself have experienced, ride at this speed on crossovers so many times that Mr. McHenry's arguments seem pitiful. As to an automatic train-stopping device, in connection with which Mr. McHenry seems to be wofully ignorant; this is not a complicated device, does not require any great ingenuity; there are many of them in the Patent Office; many of them are on the market, and any good mechanic could make one; yet it seems Mr. McHenry thinks the same preposterous. It is the arbitrary, irritable, unreasonable, illogical, and personally critical opinions promulgated by railroad officials that are causing much of the railroad legislation of to-day. The principle is clear. When vice-presidents give out unreasonable excuses for passenger train wrecks and show wanton indifference to the general subject matter, safe railroading, the natural course of events is for the law-making bodies to take action, and it is both logical and reasonable as well as proper that they should.

Your argument on the short crossover is not only proper and accurate, but in view of your position and the second accident of this kind, there is no argument for a short crossover that appeals to a man of reasonable intelligence, of any reasonable practical experience.

Council Bluffs, Iowa. W. K. MCCONNEL.

The Solar Engine in Egypt

To the Editor of the SCIENTIFIC AMERICAN:

On my return from Egypt, I have been shown two letters from your valuable paper, the SCIENTIFIC AMERICAN, one dated October 25th and the other October 31st.

We constructed a fine sun-power plant in Egypt of 100 horse-power, and it started up excellently and gave even better results than we expected, but we had not calculated on the intensity of the sunlight in Egypt, and the zinc boilers, which stood very well in America, were unable to hold out. The temperatures obtained came near the melting point of zinc, and the zinc softened and hung down like a dish rag. We were therefore compelled to put in new boilers, which are now being constructed in England. These boilers will be of one eighth inch thick steel, and every joint welded with oxy-acetylene. We feel sure these boilers will stand the temperatures. More water space has also been given, and more steam space.

We expect to start up again about the end of March, and will then be very glad to give you full information and photographs.

The pump we had in place could handle 6,500 gallons per minute. We found the engine could do much more than run the pump, and therefore had arranged already to increase the capacity of the pump to 12,000 gallons per minute, but before we could get this done, our boilers showed signs of failure.

You can see from the above that the general proposition of sun power is an assured success. The inventor of a new fuel which burns out his boilers, should rather be happy about the matter than otherwise, as he evidently obtained better results than he expected. Of course, the delay is extremely disappointing, as the entire country is interested, and we had hoped to give a fine public exhibition about the middle of October.

Tacony, Pa. FRANK SHUMAN.

Control of the Mississippi

To the Editor of the SCIENTIFIC AMERICAN:

I am delighted to note that you are giving space in your correspondence columns to the discussion of the problem of the Mississippi. This subject, like that of the Panama canal, is admirably adapted to the nationalizing of American sentiment, a result much to be desired in a country of such varying elements of population and interests as our own.

I agree heartily with Mr. Yourtee that "any work in this direction . . . should be preceded by intelligent understanding of the situation," but as heartily disagree with him in thinking that "a choice must be made between some system of diversion o· higher levees."

We must go at this job as at any other we wish to have properly done, namely, by beginning at the bottom. But the bottom of a river system is at its top. That is where it starts, and that is where it can most readily be controlled. We learn from our geographies that certain characteristics and facts pertain to all of that large class of rivers of which the Mississippi is one, namely, that these rivers have their rise in hilly or mountainous regions; that they flow toward the ocean on beds which become more and more nearly level as their mouths are approached; that moving water carries sediment and in proportion to the rate of its motion so long as it can find the sediment to carry; that as the river reaches its lower and more nearly level portions it drops more and more of its sediment; that this causes the raising of its bed and the building of banks slightly higher than the surrounding country; that with the constant raising of the banks and the bed there inevitably comes a time when the banks are broken through and the river finds a new course to the ocean; that the deposition of sediment causes the stream to become very tortuous, thus decreasing its motion and causing it to deposit a larger and larger percentage of its sediment in its middle or sub-middle sections; and that as this process continues, the danger of sudden floods causing a break in the stream's banks becomes greater and the ensuing calamity more disastrous.

Now it follows from these observations that any plan of either building higher levees or providing additional outlets is but temporizing with the problem. The higher levees must soon become, as they are to-day, a positive danger; and the additional outlet only doubles the time which may elapse before the one true plan *must* be adopted.

That plan, if my reason serves me correctly, is the construction of reservoirs in the upper courses and tributaries, in the case of the Mississippi the numerous tributaries of the Missouri in particular. The advantages of this plan are various.

From a national viewpoint it has the advantage of serving more than one section of the country. The reservoirs would be a great blessing to that section of the country in which they would be located, helping to increase the scant humidity of the atmosphere, relieving the monotony of the landscape, and furnishing means of irrigation, ice making, fish culture, various sports, and last and probably least in real value, some water power. But they would just as surely benefit the region of the lower Mississippi by reducing the danger of floods and at the same time increasing the dependability of the river as a means of navigation. For the clarifying or partial clarifying of the waters of the lower Mississippi by means of these reservoirs would have the effect of making the river pick up instead of depositing sediment, which would have the further effect of causing the river to deepen its channel and straighten its course (like the lake-fed St. Lawrence) thus increasing its rate of flow and still further increasing the desired results. And the most comfortable part of the change thus wrought would be the knowledge that the benefits thus derived would be self-perpetuating instead of being mere postponements of an ever-increasing danger. Thus we have the advantage of urging the expenditure of the nation's money for a more truly national benefit than the mere relief of the lower Mississippi by an additional outlet could possibly afford.

Likewise, from an economic viewpoint the advantages would be marked. The first reservoir constructed would immediately take off the keen edge of the danger of a break in the present levees, a relief that might mean everything to thousands at the critical moment. There would be no waiting for the completion of a great undertaking of great expense and somewhat doubtful utility before any advantage could be realized.

And last but by no means least, from an engineering viewpoint, this plan offers the tremendous advantage of making its first work a perfect foundation for any further improvement of the Fathers of Waters which future generations, more opulent than ourselves, might wish to undertake. Thus with the Northwest well supplied with these reservoirs, one does not have to stretch his imagination greatly to see the time when the entire courses of the Mississippi and Missouri rivers will be supplied with dams and locks and made into channels of commerce far more pretentious than that now asked for in the feeble cry of "fourteen feet through the valley."

Noble, Alta, Canada. N. J. NOBLE.

An Aviator on Gyroscopic Force

To the Editor of the SCIENTIFIC AMERICAN:

I was interested in the statement of R. S. Moore in your October 19th issue regarding the death of Paul Peck, the aviator.

Referring to Mr. Thomas Preston Brooke's argument in the SCIENTIFIC AMERICAN of September 28th, in which he attempted to prove that Peck's death was due to the gyroscopic action of the rotary motor in his aeroplane, I would say that Mr. Brooke has repeatedly claimed that various aviators have met their deaths from this terrible (?) force.

Did anyone hear of an aviator who has really had experience with a rotary motor complain about the gyroscopic action? Mr. Brooke acknowledges that Paul Peck never had any trouble with gyroscopic force, and yet as soon as Peck is dead and is not here to defend himself, he blames his death upon this gyroscopic effect. If it was so dangerous and if it killed Mr. Peck, why didn't he at least know of its existence before his death? I have seen Paul Peck do some pretty fancy flying, and the fact that he never was aware of any gyroscopic action leads one to think that it was not very pronounced.

There is no arguing the fact that there is a gyroscopic effect when a rotary motor is used, but I claim, as a practical aviator, that this fuss about gyroscopic action is all nonsense, and *it is absolutely negligible in practice.* As I have flown more miles in a monoplane, using a rotary motor, during the 1911 season, than any other American aviator, or I might go further and say than any other aviator in America, I am speaking from experience. Neither have I an "ax to grind," as I am not in any way connected commercially with the development of the aeroplane.

There are enough impediments in the path of the development of the heavier-than-air flying machine without putting a lot of imaginary obstacles in its way, and I claim that this gyroscopic bugaboo falls under this head.

Newton Highlands, Mass. EARLE L. OVINGTON.

Wanted: A Small Gasoline Plow

To the Editor of the SCIENTIFIC AMERICAN:

Under the foregoing heading Mr. E. M. Blacksher makes some remarks which I undertake to answer from the standpoint of the owner and operator of a gasoline plowing outfit.

Mr. Blacksher's observations are not new. Gasoline plows can be purchased in the American market at the present time. There are no mechanical difficulties in the way of manufacturing a successful machine. Only the question of economy is involved.

The farmer who is most likely to create a demand for the type of gasoline tractor referred to by Mr. Blacksher carries on diversified farming. He raises hay, corn, feed, and stock. He must have a number of horses to do tasks that cannot be performed with a tractor with any degree of success. He raises his own feed, and there is no reason why he should not raise his own horses. If he does, he is not likely to take a very lively interest in machinery.

In figuring the cost of plowing or hauling with machinery, at least four items must be considered.

First of all is the interest on the first cost of the power plant. Second, is the cost of fuel, lubricants, etc. Third, comes the cost of labor. And fourth, some allowance must be made for depreciation.

The first item must be relatively large for a small outfit, because for various reasons it is not possible to build a small tractor as cheaply per horse-power as a large one. The second item is also in favor of the larger tractor. On the third item there can be no argument, because one man can operate a large tractor quite as easily as a small one. A good man can drive a 60 horse-power tractor pulling eight plows and plowing twenty acres per day. It will take one man to operate a 15 horse-power tractor pulling two plows and to cover five acres per day. It takes just as much mechanical ability to operate the small tractor as the large one. The last item is much the same as the third. Two engines of equal material and workmanship will make the same number of revolutions and cover the same number of miles before they are worn out, everything else being equal. The small tractor has to travel four times as many miles to plow the same number of acres as the large tractor. Therefore it will wear out four times as fast as the big one on the same acreage.

This comparison does not hold with horses, which is to the advantage of the small farmer. The real demand is not for a small tractor, but for a better large tractor. The demand for large tractors is real and urgent; the demand for small tractors not nearly so important. What is wanted is an engine that will operate successfully on the cheaper oils. This must be a Diesel or some modification of the Diesel engine. It must be better balanced than our present engines. The frame should be substantial, and hot-riveting should be used wherever possible. The gearing should be of the best steel, cut and machined and inclosed so as to run in oil. This would prevent rapid wear, because dirt could gain no access. It would also prevent expensive delays and breakdowns.

An engine such as I have in mind would find a ready sale among men of mechanical ability, men who would do the plowing and all the heavy work for small farmers more cheaply than the same work could possibly be done by a small machine. INGOLF BIRKELAND.

Judith Gap, Mont.

How Electricity Makes the Dairy Cleaner

Watertight Electric Light Fixtures Permit of Thorough Daily Washing

By Putnam A. Bates, E.E.

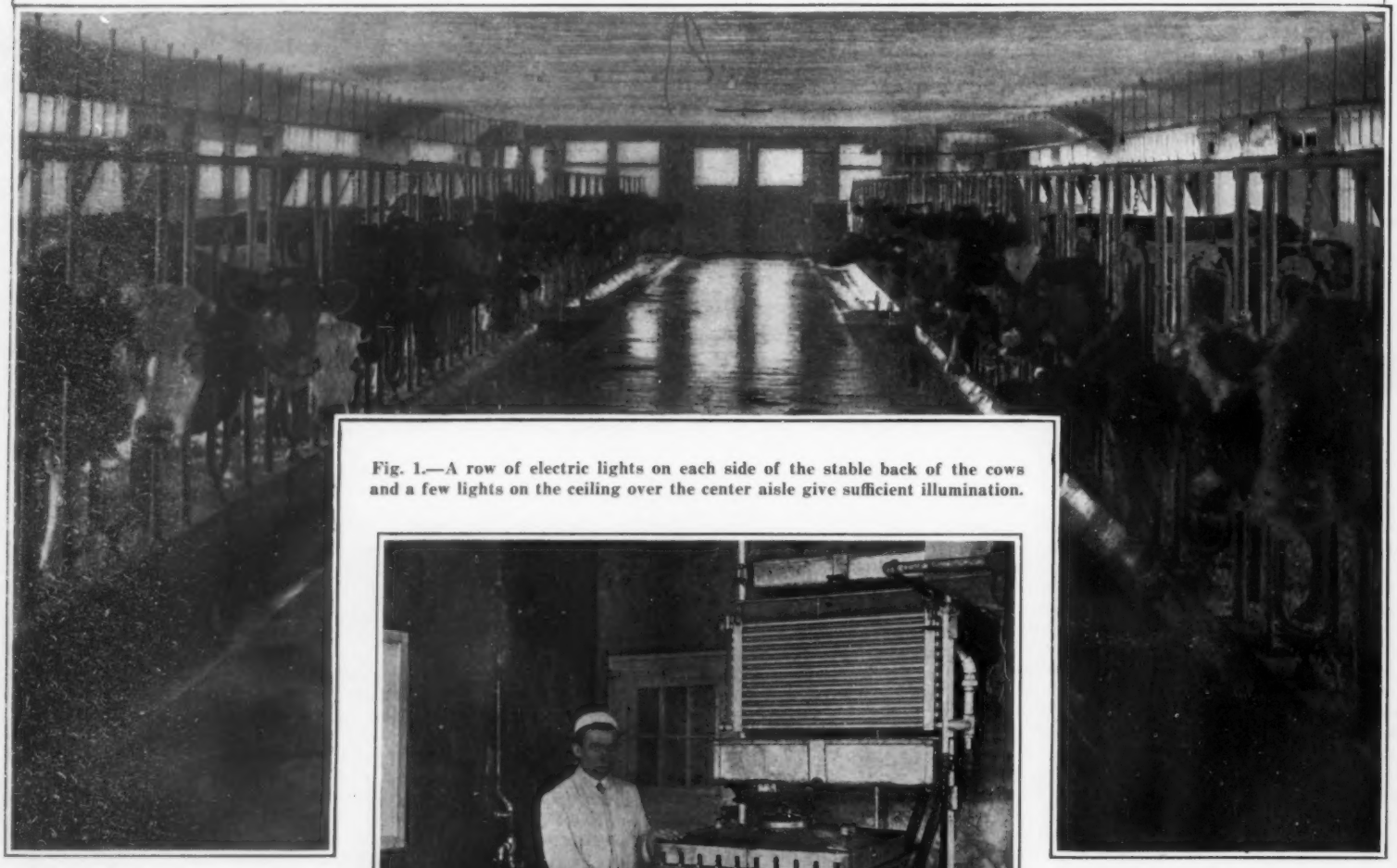


Fig. 1.—A row of electric lights on each side of the stable back of the cows and a few lights on the ceiling over the center aisle give sufficient illumination.

Fig. 2.—In this picture is shown a bottling room at a "certified" milk farm in Morristown, N. J. The hose is used twice daily to wash down the entire interior. In fact, all buildings at this farm undergo the same treatment.

Fig. 3.—Milking at 3 A. M. by electric light seems a luxury, but for clean milk it is a necessity.

EVERYONE knows that the secret of success in dairy farming is cleanliness.

Where there are two commercial dairies in a community, the one giving the more attention to sanitation will naturally stand the higher in popular opinion, and this is true irrespective of other commercial conditions. But how may cleanliness be assured? Good light and plenty of good clean water are the requisites, of course. The question then becomes: How may these be obtained most conveniently?

Dairy farms are all improving very rapidly, and it is an interesting fact, not generally known, that 50 per cent of the large milk producing farms of this country to-day use electricity at least for lighting purposes, and in a considerable number of such instances the current is also used for pumping and other power purposes.

While the advantages of electricity lie not in cleanliness alone, undoubtedly where dairies are so equipped, this factor proves the greatest benefit.

The writer's purpose is to describe the conditions at two of the leading dairies of New Jersey. The larger one comprises a farm of twelve hundred acres, at Plainsboro, N. J., 70 per cent of which is under cultivation. From 3,500 to 4,000 quarts of milk is the daily output of this dairy, and the milk finds a ready market at a good price. The milk is clean and the conditions under which it has been produced and shipped are such that no change can take place in its content until the bottles are opened by the consumer.

The engine room at this dairy is equipped with a 25 kilowatt electric generator directly connected to a simple reciprocating steam engine. From this unit emanates much of the life and activity of the entire establishment. It is, perhaps, unjust to say that this is the most important feature of the dairy, because there are a great many departments in such an enterprise, each having successfully to carry its burden. But it may be said, without prejudice, that as the current is used for lighting or power in each and every important building on the farm, should the electric service which this little set provides, for any reason fail, the loss would immediately affect the operation of all the other departments on the farm.

This is an evidence of the position which electricity holds in one of the largest and best equipped commercial dairies in America.

In the accompanying illustrations we show two interior views from a well-known dairy which supplies milk to several of our eastern cities and suburban communities. These are representative of its class, and, therefore, will serve for elucidation.

Fig. 2 shows the bottling room in the other dairy, Morristown, N. J. This is a "certified" milk dairy, and one of the requirements under which the product is produced is that the interior of all the milk buildings shall be washed down twice daily. In this room a watertight electric light fixture is in the ceiling, directly over the bottling machine. No other means of permanent lighting could be used in such a place and permit of this rigorous cleansing. Portable oil lanterns are not clean, therefore they are quite unsuitable for milkers to have to depend upon, in a sanitary dairy.

One dairy, the cow stables of which are shown in Figs. 1 and 3, has made its growth on the basis of cleanliness. Each building, while simple in construction, has embodied in its design every idea that will make for better sanitation.

In the upbuilding of this institution one of the first equipments adopted was an electric generating plant, used at first for lighting the residence and office build-

(Concluded on page 498.)

Some Novelties in Glider Construction

By Noel J. Deisch

GLIDERS have become so common nowadays that the general form and dimensions required for sustentation are well known; in fact, almost every amateur of any ambition has made or is making one of the recognized biplane pattern, with slight variations in regard to the position and operation of the rudders, curvature of the wing surfaces, and manner of control. After he has experimented for a short time with his machine the amateur will usually discover that his means of alighting is dangerous, that the arc described by the horizontal rudder is of insufficient amplitude for maintaining stability, and that altogether the machine is too unwieldy, and so bulky that it requires more space for storage than he has at his disposal.

Having had some experience with machines of this description, and having met all the difficulties enumerated, I will attempt to give some idea of the manner in which I overcame them, so that prospective builders will profit by my experience. The machine which I chose to build is the one described in SCIENTIFIC AMERICAN SUPPLEMENT No. 1582, with the slight difference that four feet was added to the span of the wings. I soon found that the rudder was open to the triple objection that it was clumsy to operate, did not have enough working space and was so low that on landing it was very liable to be seriously damaged. Accordingly the form of the support was changed to that shown in Fig. 1, which, of course, increased the angle through which the rudder might move and elevated it to such an extent that there was no more danger of injury. The control system and seating arrangements which were employed are illustrated in Fig. 2. The seat is of canvas securely sewed and so made that it may be slid back and forth readily on the supporting members to suit the operator. The control consists of two parts, movable, as indicated by the arrows, that which moves the vertical rudder sliding laterally over the bar which controls the horizontal rudder. The latter moves up and down and is guided upon two of the struts. Both members of the control are provided with wire hooks which pass entirely through the wooden bar and receive the loops in the picture-frame wire which is used for working the rudders. It may be observed that the hands need never be removed from this type of control for working either of the rudders, and that it is much lighter, more positive, and has a greater range than has a lever. The rudder wires pass over light brass pulleys which may be purchased at any hardware store. A plan view of the rudder arrangements is shown in Fig. 3, while a lateral view is shown in Fig. 1. These are self explanatory.

Skids may be made so light and are so serviceable, that it is a wonder that they are not used more frequently. An idea of their construction may be gained from Fig. 1. They should be braced to the machine laterally by means of piano wire. In landing they should be allowed to support the weight of the machine only, the operator taking care of his own weight by himself.

Using the construction which I have endeavored to describe, it will be found very easy to make the machine demountable. The front and rear rudder supports and the skids may be removed and placed between or above the planes, and the whole will be found to occupy about one fourth of the floor space required previously. To make this possible all control wires should be provided with loops which may be slipped over hooks when the machine is being prepared for an experiment. In my opinion the removable frame should always be securely lashed to the plane members with leather belt-lacing in preference to being bolted, as bolts are not only heavy, but are very liable to weaken the frame if much skill is not used in attaching them.

The experimenter must change the dimensions to suit his own type of machine; those given are intended merely as suggestions. I might say that for the glider referred to in SCIENTIFIC AMERICAN SUPPLEMENT No. 1582 I have found those shown to be entirely satisfactory. Of course, all dimensions not indicated are the same as those shown in the SUPPLEMENT mentioned.

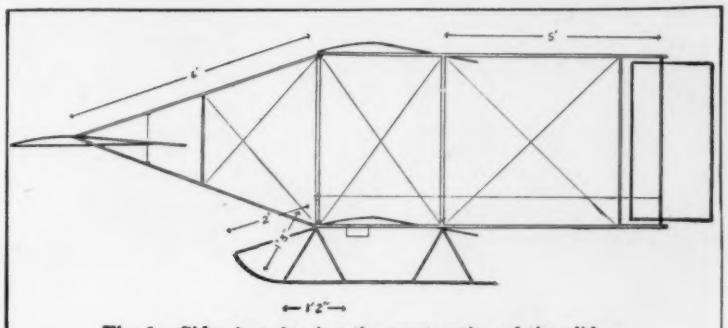


Fig. 1.—Side view showing the construction of the glider.

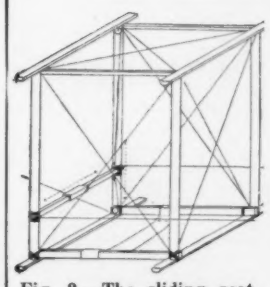


Fig. 2.—The sliding seat and rudder controls.

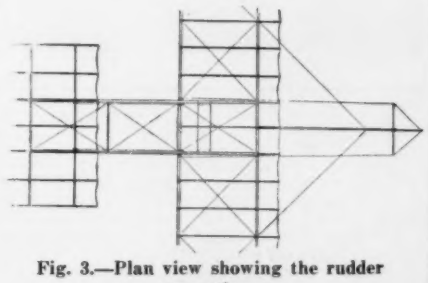
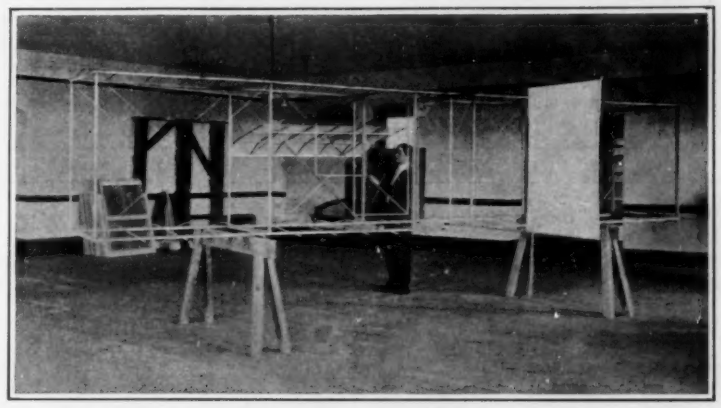


Fig. 3.—Plan view showing the rudder connections.



Assembling the framework of the glider.

The glider at the instant of landing.

The Function of a University

IN an address at Columbia University opening exercises by F. J. E. Woodbridge, Ph.D., dean of the graduate faculty, the speaker said that while mind is man's natural possession, the discovery of its use and significance in his life is a genuine discovery which enlarges his vision, begets the sense of a new and unlimited power, and gives him a new confidence. An historian might claim that the discovery marks the important crisis of civilization. It is set down as one of the striking events which characterized the beginning of what we call modern times. Yet it is not something incident to an artificial period of time. It is the one event which makes it possible to regard the past as antiquity—the sum of things accomplished—to view the present as opportunity, and to see the future ahead. It is not a characteristic of modernity, but its essence.

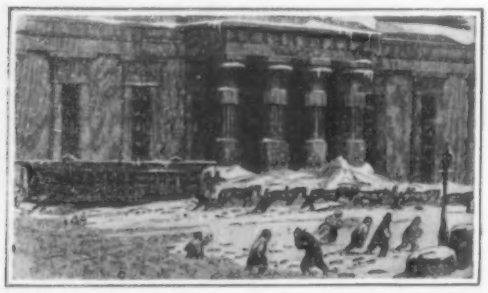
Schools exist because the mind has been discovered. Their obvious purpose is to keep us acquainted with the mind and to promote the intelligent penetration of things. If this is true, then the discovery of the mind should be the source of our educational programmes and the criterion by which they should be judged. Are we making intelligence prevail? Are we invading with the spirit of inquiry every department of life? Are we letting no chance slip to bring under the control of reason the least as well as the greatest undertakings of men? Of such a type are the questions which those who believe that mind has been discovered will ask; and they will insist that their labors be judged by the standards such questions suggest and by no others.

Such questions determine the point of view from which the rapid expansion of our universities should be regarded. It is short-sighted to see in this expansion principally the abandoning of what is old and tried and the rushing into what is new and popular. We hear of "new ideas of a university," but in strictness of speech—or one might say, metaphysically—there can be no new idea of a university which is not a wrong idea. For there is something Platonic and eternal about that idea, a changeless essence which may shine through many changing things. The only sense in which it can be called new is the sense in which we indicate that some one has seen it for the first time in his own experience. There may be new courses, new methods, and new degrees, and these may displace older and long established institutions, but there can be no new university. The accidents are old or new, the substance never; for the idea of the university is the idea of the organized discovery of the mind.

The university is, therefore, not simply a place where a number of people are engaged in teaching and being taught a number of subjects of greater or less importance. It is much more than a collection of different schools brought together under one administration for purposes of economy or size. It is much more than a haphazard arrangement of different courses leading to different degrees and framed to meet demands of the moment, or to illustrate passing fashions, or to compete with rivals. To see no more is to see with myopic vision. To be sensible of no more is to be insensible to opportunity. The university is always at the beginning of a greater career when it finds a region which intelligence can invade and master, for that means progress in organizing the mind's discovery. It looks with a jealous eye on every educational enterprise and every attempt to advance learning which seeks an independent existence.

We should enhance the belief that the university is in idea, and shall be increasingly in practice, the most important of human institutions. It sets faith in the controlling power of the mind in contrast with faith in any other power. It insists that a technique of curiosity, criticism, and control is superior to every other kind of technique, because it is applicable to every undertaking. It demands, since there is always an intelligent and rational way of doing what needs doing, that that way be found and followed, not only in mathematics and philosophy, in literature and science, in industry and the arts, but also in public life, in business, in politics, in society, in morals, and in religion. The proposition that we must think one way in the cloister, but must live and behave a different way in the market, is to it intolerable. The notion that we are the products of our ancestry, it supplements with the notion that we are the ancestors of posterity, making us thus indebted to the past, but obliged to the future. It aims to be the place to which men can look for judgments which are disinterested and, therefore, just. It is content only as it sees ignorance, prejudice, passion, partisanship, superstition, and privilege progressively giving place to the life of reason.

History may be read in terms of politics, or of economic forces, or as an evolution. It may also be read in terms of the discovery of the mind. We may see man rising from the ground, startled by the first dim intimation that the things and forces about him are convertible and controllable. Curiosity excites him, but he is subdued by an untrained imagination. The things that frighten him, he tries to frighten. He would scare the earth's shadow from the moon and sacrifice his dearest to a propitious sky. It avails not. But the little things teach him and discipline his imagination. He has kicked the stone that bruised him only to be bruised again. So he converts the stone into a weapon and begins the subjugation of the world singing a song of triumph by the way. Such is his history in epitome—a blunder, a conversion, a conquest, and a song. That sequence he will repeat in greater things. He will repeat it yet and rejoice where he now despairs, converting the chaos of his social, political, industrial, and emotional life into wholesome force. He will sing again. But the discovery of the mind comes first, and then the song



1849. Harlem Railroad car, drawn by horses, passing the Tombs Prison.

Monumental Gateway to a Great City

Completing the Grand Central Terminal, New York

1857. Terminal Station on site of present Madison Square Garden.

IN tracing the history of that great system of railroads known as the New York Central Lines, we must go back to the year 1832 in time, and in place to the City Hall Park, New York city. Here, on Center Street, was built the small terminal station of the New York and Harlem Railroad, whose double tracks were carried down Park Avenue and Center Street to a point near the City Hall. The cars were not nearly so large as, nor did they approach in comfort, our present street cars, and the locomotives could have been comfortably stowed within the firebox of the largest locomotive of the present day. The City Hall station was in the uptown district of the city of those days; but during the first two decades of the operation of the road, the growth of population and traffic northward on Manhattan Island, necessitated the construction of a new terminal farther uptown, and in the late fifties a new station was built at Twenty-sixth Street and Fourth Avenue on the present site of Madison Square Garden. The new structure was considered to be one of the notable buildings of the city of that day; yet it is a fact that it could be set down in the express concourse of the station of 1912, without touching the walls or reaching the roof above. In 1857 the use of steam locomotives south of Forty-second Street was discontinued and for many years the cars were hauled to the City Hall and back by teams of horses. So rapid was the growth of the city, however, and the increase in the traffic, that the company decided to build at Forty-second Street a large terminal, to be known as the Grand Central Station; and, profiting by the experience of the past, they determined to construct both the yard and the train sheds on a scale of magnitude that would accommodate the traffic of the road for many a decade to come.

Apologia

Architecture being a reasoned art, for any specified purpose there should be precedent and tradition—every motive and element should have its reason for being, and in all compositions, no matter how simple, the elements must explain themselves and justify their presence. In ancient times the entrance to the city was through an opening in the walls or fortifications. This portal was usually decorated and elaborated into an Arch of Triumph, erected to some naval or military victory, or to the glory of some great personage. The city of to-day has no wall surrounding that may serve, by elaboration, as a pretext to such glorification, but none the less, the gateway must exist, and in the case of New York and other cities, it is through a tunnel which discharges the human flow in the very center of the town. Such is the Grand Central Terminal, and the motive of its façade is an attempt to offer a tribute to the glory of commerce as exemplified by that institution. The architectural composition consists of three great portals crowned by a sculptural group, the whole to stand as a monument to the glory of commerce as typified by Mercury, supported by moral and mental energy—Hercules and Minerva. All to attest that this great enterprise has grown and exists not merely from the wealth expended, nor by the revenue derived, but by the brain and brawn constantly concentrated upon its development for nearly a century.

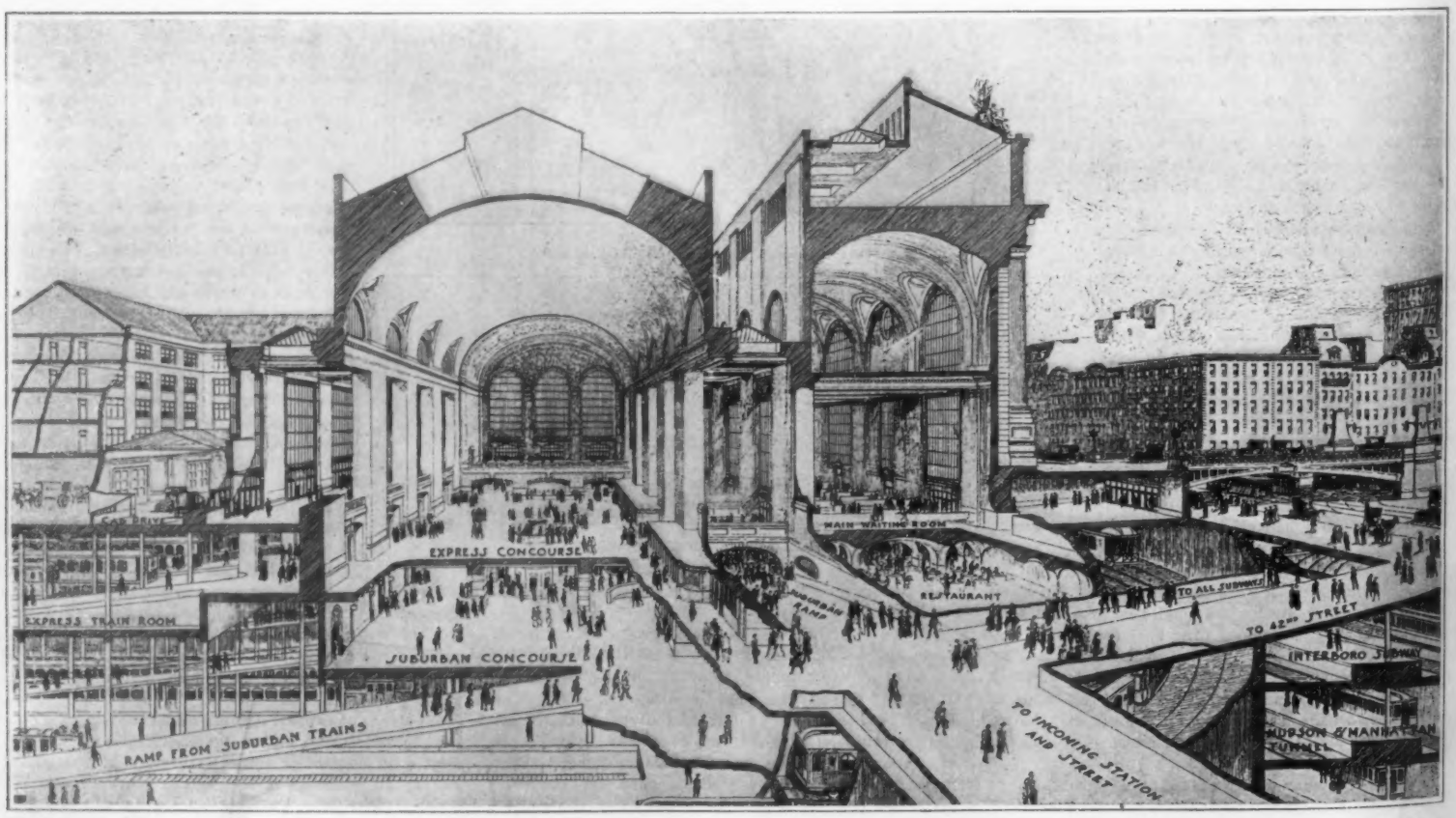
WHITNEY WARREN.

The present New York Central and Hudson River System was organized by Commodore Vanderbilt in the year 1869, and in the same year the construction of the first Grand Central Station was begun. Two years later it was opened to the public. The train shed, the largest, by far, that had ever been built in the United States, was covered in by a single arched roof, 200 feet in span and 600 feet in length. Within it, fifteen tracks were accommodated and during every twenty-four hours eighty-eight trains entered and left the station. During the first year of operation four millions of people made use of the new terminal.

Twenty-five years later the traffic had increased so greatly that the station had to be enlarged. Additional tracks were laid and the capacity of the building was increased by adding three stories above the old structure. This work was done in the year 1900. Scarcely was the improvement completed, however, before it began to prove inadequate.

Demand for Greater Facilities.

It now became clearly manifest to the management of the New York Central Railroad that, if adequate provision was to be made for the increase of the future,



At the left are the express and suburban platforms, with inclines leading to the respective concourses, waiting rooms and restaurants. At the right are the street surface lines and the Interborough, Hudson and Manhattan, and Belmont tunnels, by which the traffic is distributed throughout Greater New York and Jersey City.

General sectional view of the Grand Central Terminal.

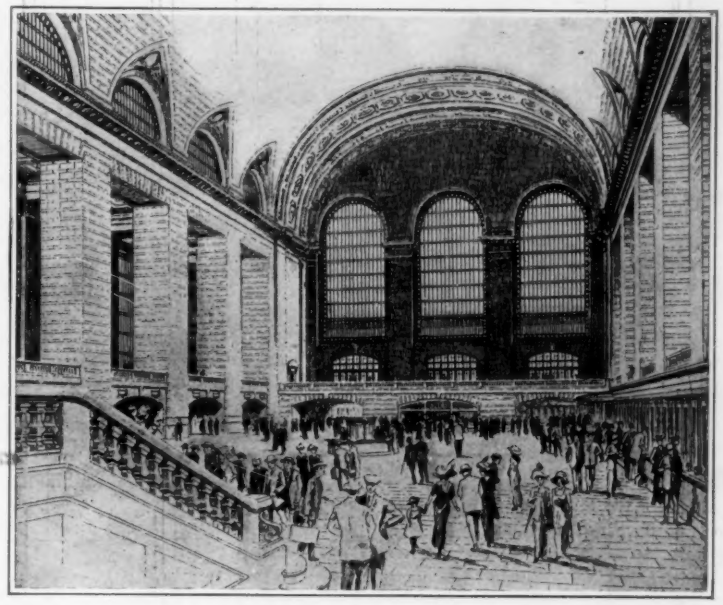
nothing short of the entire reconstruction of the station yards and the terminal building upon a vastly greater scale, and the adoption of an entirely new principle, both in the movement of the trains and the handling of the outgoing and incoming traffic, would meet the conditions. Two factors in particular had to be reckoned with. One was the unparalleled rate of growth of the population of New York and its suburbs, and another was the growing popularity of the outlying districts for residence and the consequent enormous increase in suburban traffic. How greatly this has grown is shown by the estimate that, at the present time, nearly one and a quarter million people enter New York daily from within a radius of twenty-five to thirty miles. A large portion of this inflow finds its way through the Grand Central Terminal; and it is necessary to handle it, night and morning, expeditiously and with convenience both to the public and the railroad companies, whose heavy service of express through trains must not be hindered.

The Traffic Problem.

In order to realize the difficulties which confronted the company in meeting existing conditions, it should be understood that all the trains which enter the Grand Central Terminal have to pass through a four-track tunnel, running below Park Avenue to Fifty-sixth Street, where the tracks diverge into the terminal yard. Under previous methods of operation, the trains ran into what are known as "dead-end" tracks, under the train shed, where the passengers disembarked. The empty cars had then to be drawn back to Mott Haven, to the north of the Harlem River, for cleaning and preparing for the next trip; after which they had to be drawn again through the tunnel into the terminal. It is evident that this arrangement practically doubled the train movements through the tunnel; or, in other words, exactly halved its capacity for passenger service. For some years it had been recognized that the ideal arrangement would be to remove the storage and cleaning yard at Mott Haven to the terminal at Forty-second Street. This, however, would have necessitated a great increase in the size of the yard and large purchases of real estate at high prices. Outside of the objection on the score of the great cost was the even more serious one of the noise, dust and smoke occasioned by the presence of an ever-increasing number of steam locomotives in the very heart of the city. The solution of the problem came, as it so often does in human affairs, in an unexpected way and from an unlooked for quarter. For there can be no question that the serious collision in the tunnel, near the terminal yard, in January, 1902, occasioned by the failure of the engineer of a train to see the smoke-and-steam-obscured signals, was the predisposing cause which led, ultimately, to the erection of the present magnificent terminal station and yard. The accident resulted in legislation at Albany, which required the railroad, after a certain date, to substitute electrical for steam operation through the Park Avenue tunnel.

Electric Operation and "Air Rights."

When the New York Central Railroad Company found themselves confronted with the problem of electrifying their terminal lines and station, it was realized that they had before them a task of great difficulty, involving new problems and calling for the most careful deliberation. It was at once determined to take advantage of the situation by building a new terminal on a scale of size and magnificence which had never been approached in any other terminal station in the world. This point being settled, the question arose as to how to secure the additional space necessary. The purchase of the twelve or fifteen city blocks that would be required would have involved a staggering outlay of money, which, added to the cost of electrification and of the great terminal structures which were contemplated, raised the total estimate of cost to a figure which even this wealthy corporation could not contemplate without some dismay. It was at this juncture that the chief engineer of the road, Mr. W. J. Wilgus, submitted to President Newman an alternative scheme, the merits of which were quickly appreciated and received the necessary indorsement. The plan was to utilize the "air rights" above the existing station yard, by placing the new yard and platforms entirely below the street level; roofing the tracks over; restoring the intersecting streets to city use; and utilizing the forty-six acres covered by the yard, by renting out the many blocks thus rendered available, for the construction of hotels, apartment houses, clubs and such other buildings as might be determined upon. The comparative estimate of the cost of a surface as against a subsurface station, showed that excavating below ground and building above ground, and thereby utilizing to the full the air rights, would yield to the company such large rentals that a good return would be realized, even upon the vast amount of capital invested.



Express concourse; a noble hall, 120 by 272 feet, finished in Botticino marble.

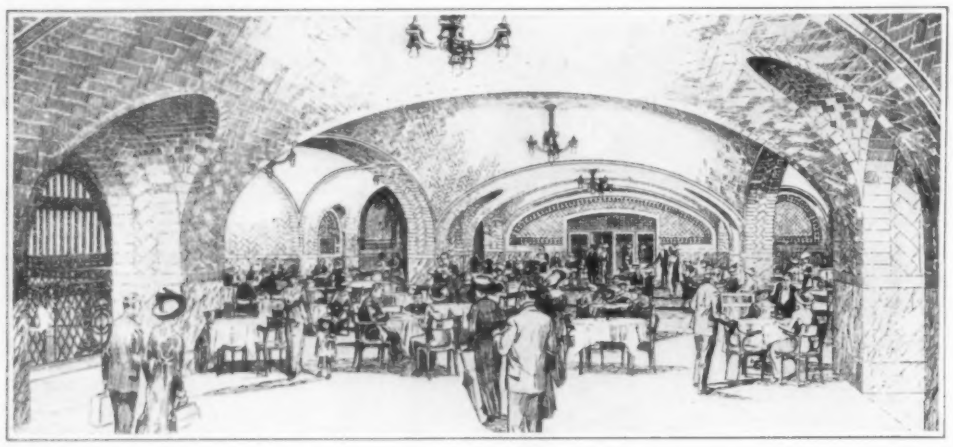
The general waiting room, capable of accommodating five thousand people.

Direct Versus Alternating Current.

The substitution of electrical for steam traction having made it possible to utilize the air rights by building a terminal yard and station entirely below street level, the important question presented itself as to what system of electric traction would best meet the conditions. President Newman quickly realized how vital a question this was. There was no precedent whatever to go upon. The conditions were new; the problem quite untried. Moreover, at this time there were two great rival systems of electric traction in the field, the direct current and the alternating current. Very wisely, President Newman organized a special board of electrical and engineering experts to thrash out the question. They did so; and it took them two years to come to their final conclusion that, all things considered, the direct-current, third-rail system would best meet the conditions. The New York, New Haven and Hartford Company also have their terminal at the Grand Central Station. The management determined to electrify their main lines as far as Stamford, Conn., and after mature consideration, they decided to adopt the alternating-current, high-tension system, using 11,000 volts in an overhead line. The New

To the left is a completed section of the express level. In the center excavation is in progress. To the right is a section of the old yards. To the rear are the new post office building and the old train shed.

Three stages in the construction.



The restaurant with its fine vaulted ceiling.

York Central suburban electric zone was to extend thirty-four miles to Croton on the main line and thirty miles to White Plains on the Harlem. The direct-current system has the advantages that the third rail affords a more compact and ship-shape system of construction; that the pressure is lower; and that the risks of accident are reduced practically to the vanishing point. The company have done the electrical world great service by publishing very complete details of the original cost, cost of operation, and the risks and accidents of operation, thereby placing the art of steam, trunk line electrification in possession of a large amount of very useful data. The New Haven Company has also published the facts as to convenience of operation, reduction of train movements, etc., but, unfortunately, they have been absolutely silent on the all-important question of the relative total cost of operation by the alternating-current system, as compared with that of operation under steam. It is sincerely to be hoped that these important data will soon be forthcoming.

Some Facts and Figures.

Just here, before describing the work of building the yard and station, it will be well to give some facts and figures showing the magnitude of the task with which the architects and engineers were confronted. In the first place, the total area of the station is seventy acres, which is exactly two and one half times as great as that of the next largest station, the Pennsylvania Terminal, Manhattan, which covers twenty-eight acres. It is over seven times as large as the area of the Boston South Station, and over six times the size of the Frankfort Main Station in Europe. It has a total of sixty-eight tracks, of which forty-six have platforms, as against twenty-one tracks in the Pennsylvania Terminal, thirty-two in Boston and St. Louis Stations, and eighteen in the Frankfort Main Station. The work of placing the two levels of the station below ground involved the excavation of three million cubic yards of material, chiefly rock, and hauling it away for a distance of from ten to thirty-five miles from the station. Thirty-two miles of track had to be laid. The old station of steel, glass and stone had to be removed. In the construction of the roof of the suburban level, the viaducts at the cross streets and at Park Avenue and the Main Building, there had to be erected no less than one hundred and eighteen thousand six hundred tons of steel work. This is over twice as much steel as was used in the construction of the existing subway in New York city and Brooklyn.

Comparative Statement—Principal Passenger Stations in the United States and Europe.

	Total Area, Acres.	Length Track, Miles.	Number of Tracks.	Number of Platforms.
New Grand Central Terminal	70.0	31.8	46*	30
Pennsylvania, N. Y. City	28.0	16.0	21	11
Chicago & Northwestern, Chicago	8.0	2.7	16	8
St. Louis Union Station	10.9	5.4	32	16
Boston South Station	9.2	15.0	32	19
Washington, Union Station	13.0	....	29	13
Cologne	5.8	3.4	14	9
London, Waterloo Station	8.75	....	18	..
Dresden, Main Station	7.0	3.0	14	8
Paris, St. Lazare	11.2	3.5	31	14
Frankfort Main Station	11.0	....	18	9

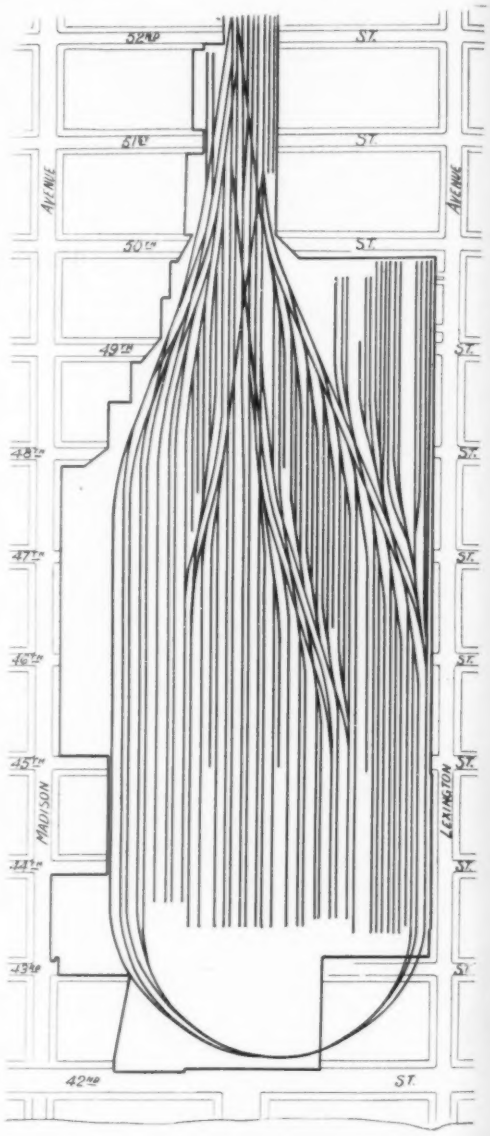
* Of the total 68 tracks these 46 have platforms.

The fireproofing of the terminal—incasing the steel work and building floors and partitions—called for 1,700,000 square feet of terra cotta hollow tile.

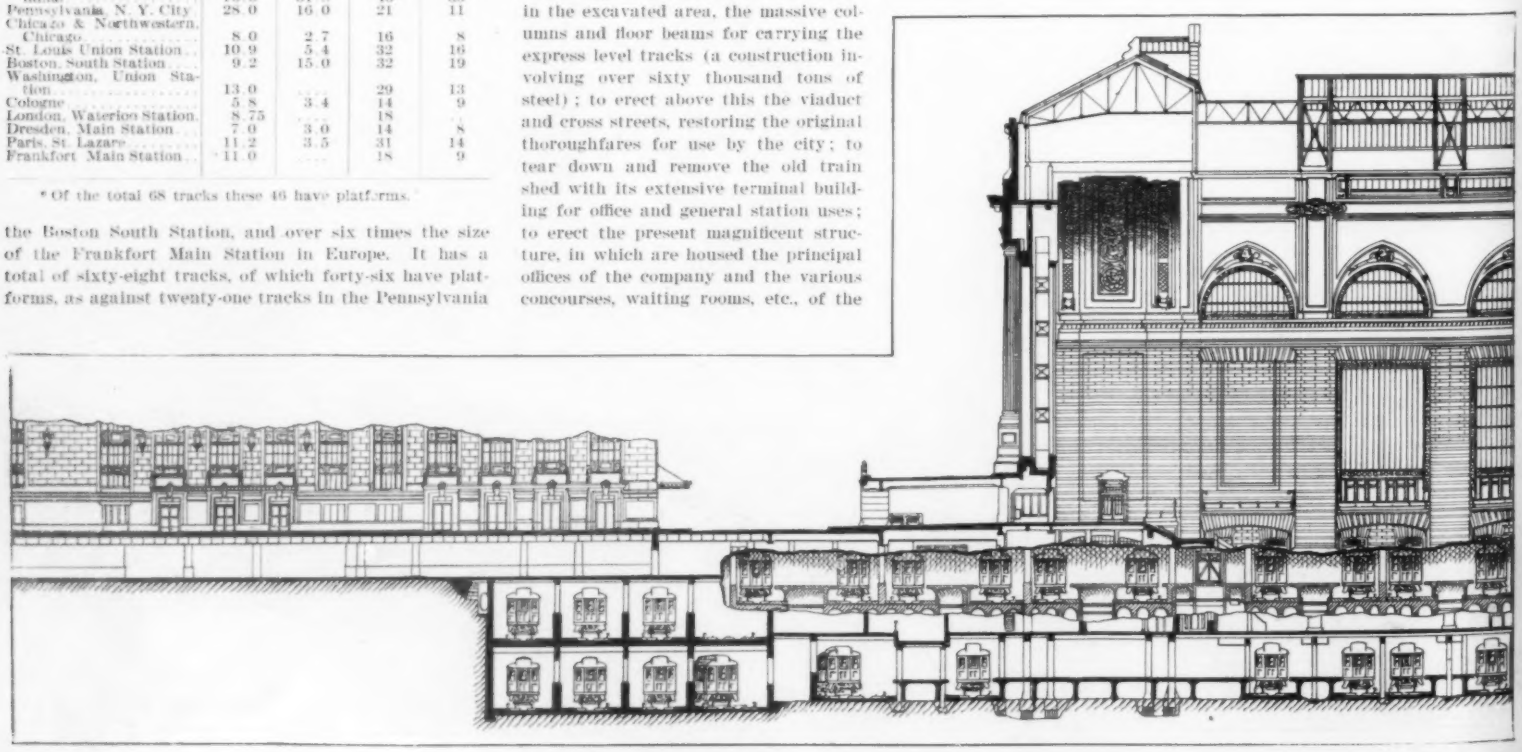
This constitutes a gigantic task of construction under any circumstances; but when we bear in mind that the whole of this work of pulling down, of excavating, of building up, had to be done either below or by the side of the constantly-moving traffic of one of the greatest railway terminals in the world, and to be done without any interference whatever with that traffic, it will be admitted that the approaching successful completion of this great work reflects the highest credit upon every one concerned in its execution—management, engineers, architects, contractors, and the operating staff of the railroad terminal. Americans are justly proud of their engineering achievements in works of great magnitude, and among these the building of the world's largest terminal under such exceptional difficulties must always remain one of the most notable.

The Engineering Problem.

Briefly stated, the engineering problem was to remove the old train shed and terminal building; to excavate the whole forty-six and a half acres to an average depth of 45 feet; to erect in the excavated area, the massive columns and floor beams for carrying the express level tracks (a construction involving over sixty thousand tons of steel); to erect above this the viaduct and cross streets, restoring the original thoroughfares for use by the city; to tear down and remove the old train shed with its extensive terminal building for office and general station uses; to erect the present magnificent structure, in which are housed the principal offices of the company and the various concourses, waiting rooms, etc., of the terminal; to lay down the thirty-two miles of track in the yard and station; and to do all of this without interfering with the regular operation of the trains running into and out of the station. The plan of construction adopted and so successfully carried through was to commence excavation on the easterly or Lexington Avenue side; and, as fast as the work was



The forty-one tracks of the express level.

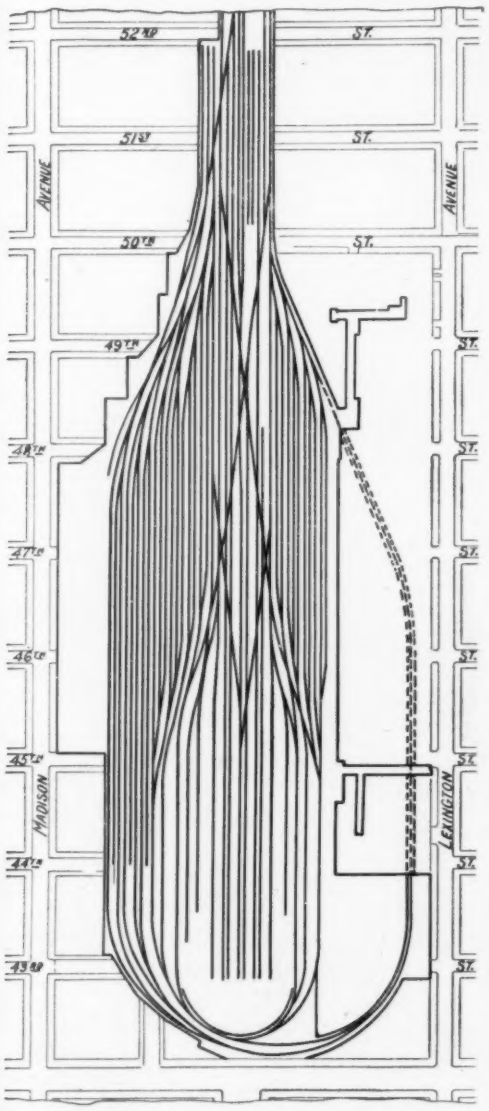


The incoming station.

Sectional view through the

G ...ONAL VIEW OF THE TERMINAL BUILDINGS

carried down to grade, to erect upon it the steel work for the two new levels, lay the tracks upon it, and transfer the trains gradually from the old to the new levels. This plan has been followed out with great success. We draw attention to the view of the work on page 485, taken while it was in full swing, which shows at the left a completed section of the station yard and tracks with electric trains standing upon them. In the center is the work of excavation, and to the right a section of the original yard. In the background, to the left, is shown the new post office building, in which are housed also a great many of the managing and clerical offices of the railroad. In the center is the old station train shed and terminal building. The work has progressed gradually from east to west; and to-day the remaining excavation below Vanderbilt Avenue is being pushed to completion.



The twenty-seven tracks of the suburban level.

The suburban concourse, reached by the gentle incline to the left.

A New Civic Center.

By referring to our front page engraving, it will be seen that for the present, the station yard tracks will be exposed to view in the area north of the station; ultimately, however, these spaces will be covered by buildings designed to present as far as possible a monumental effect; and it is probable that the buildings will include museums, hotels, business blocks, theaters, clubs and other structures which admit of bold architectural treatment on a large scale. If the present plans are carried out, the buildings will be erected by the Railroad Company and leased for a long term, probably ninety-nine years. The cost of the buildings will be repaid to the company in yearly installments. Such a plan has the great advantage that the railroad company can reserve the right to exercise a strict supervision over the architectural features of the building, which, as far as possible, will be of classical or semi-classical treatment. A unique and highly commendable feature is the fact that, when the thirty-two blocks of the station site have been built over, they will contain but two chimneys—these being the two smokestacks of the terminal power house, situated in one corner of the site, at Fiftieth Street and Lexington Avenue. All light and heat for the buildings will be furnished from this power house. Ultimately, when the whole area shall have been covered in, there will rise upon the site of the old and unsightly yard with its smoke and dirt and noise, a new section of the city, which in the dignity and harmony of its architecture will be unequaled in any part of Greater New York.

The Design of the Terminal Building.

It is probable that no building in ancient or modern times has been made the subject of such an exhaustive study as the new Grand Central Terminal. Two prominent firms of architects in this city, Messrs. Warren & Wetmore and Messrs. Reed & Stem, have collaborated in the work. To the former firm is due the broad outlines of the design and what might be termed the general æsthetic treatment of the subject, while the latter firm are responsible for what might be called the engineer-architect feature of the work. There is a general consensus of public opinion that this collaboration has resulted in a building of which the city may justly be proud. Among the great terminal stations of the world, we know of none that surpasses this in the conformity of its architecture to the purposes of the building. The general effect is one of great dignity and beauty; and the decorative features have been so judiciously applied that they fulfill their proper purpose of accentuating the principal architectural elements of the structure rather than, as is so often the case, detracting from them.

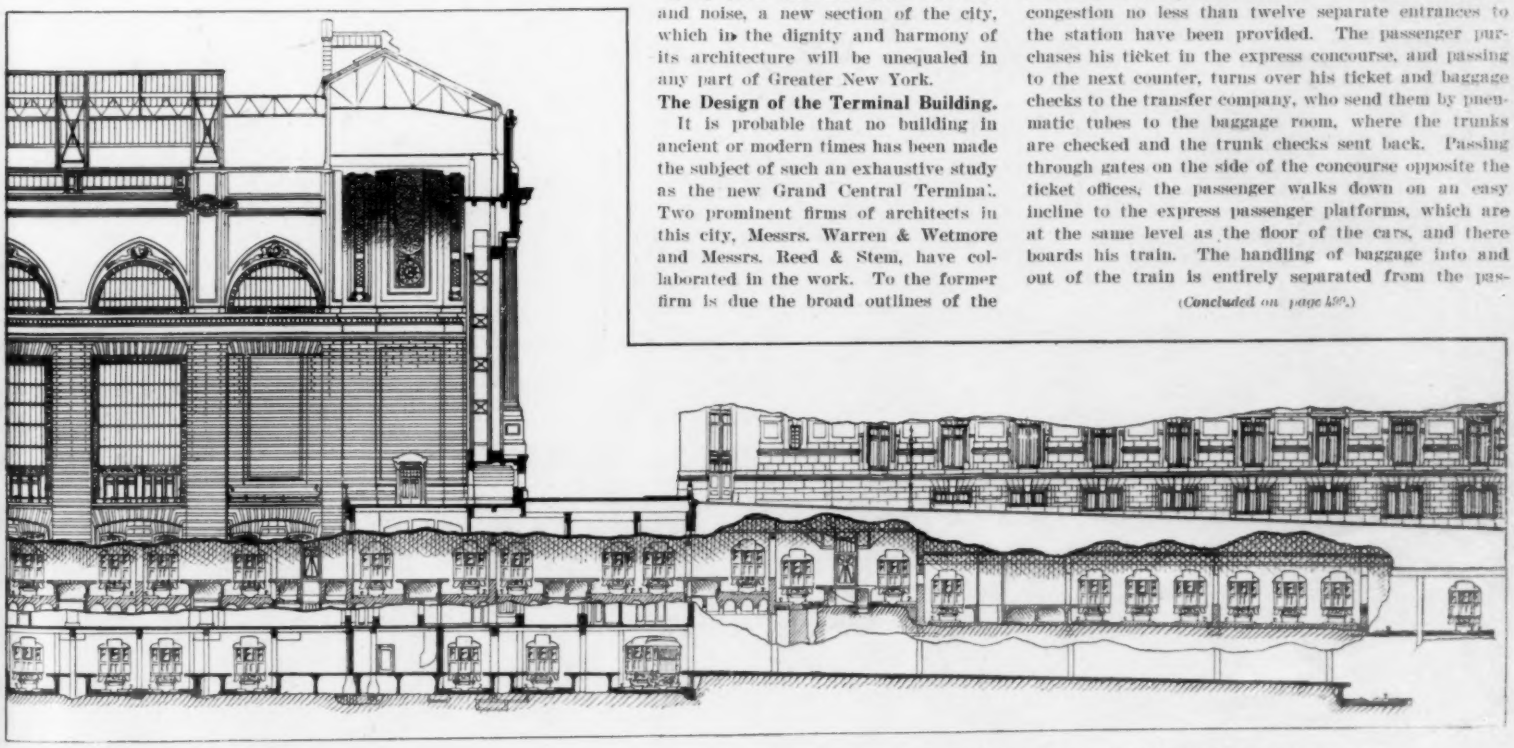
As forming the commercial gateway for a great system of railways to the heart of the country's greatest city, the Forty-second Street façade, crowned by its imposing group of statuary, must be pronounced a notable architectural success.

Interior Arrangement of the Terminal.

The new terminal station will have four separate levels. At the grade of Forty-second Street will be the gallery; below that the great concourse on the level of the forty-one tracks that will handle the through express trains. On the third level will be twenty-seven tracks for the suburban trains; and below these, running east and west below Forty-third and Forty-fifth streets, will be subways for handling the inbound and outbound baggage.

Great attention was paid to the problem of separating the inbound from the outbound traffic, so as to insure that the passengers and their baggage would flow in an unbroken stream from street to train or from train to street. As part of this plan, it was decided to abolish stairways and substitute inclined planes or "ramps" as they are called, which, after much experimentation, were built on a grade of eight feet rise to every hundred feet of length. To avoid congestion no less than twelve separate entrances to the station have been provided. The passenger purchases his ticket in the express concourse, and passing to the next counter, turns over his ticket and baggage checks to the transfer company, who send them by pneumatic tubes to the baggage room, where the trunks are checked and the trunk checks sent back. Passing through gates on the side of the concourse opposite the ticket offices, the passenger walks down on an easy incline to the express passenger platforms, which are at the same level as the floor of the cars, and there boards his train. The handling of baggage into and out of the train is entirely separated from the pas-

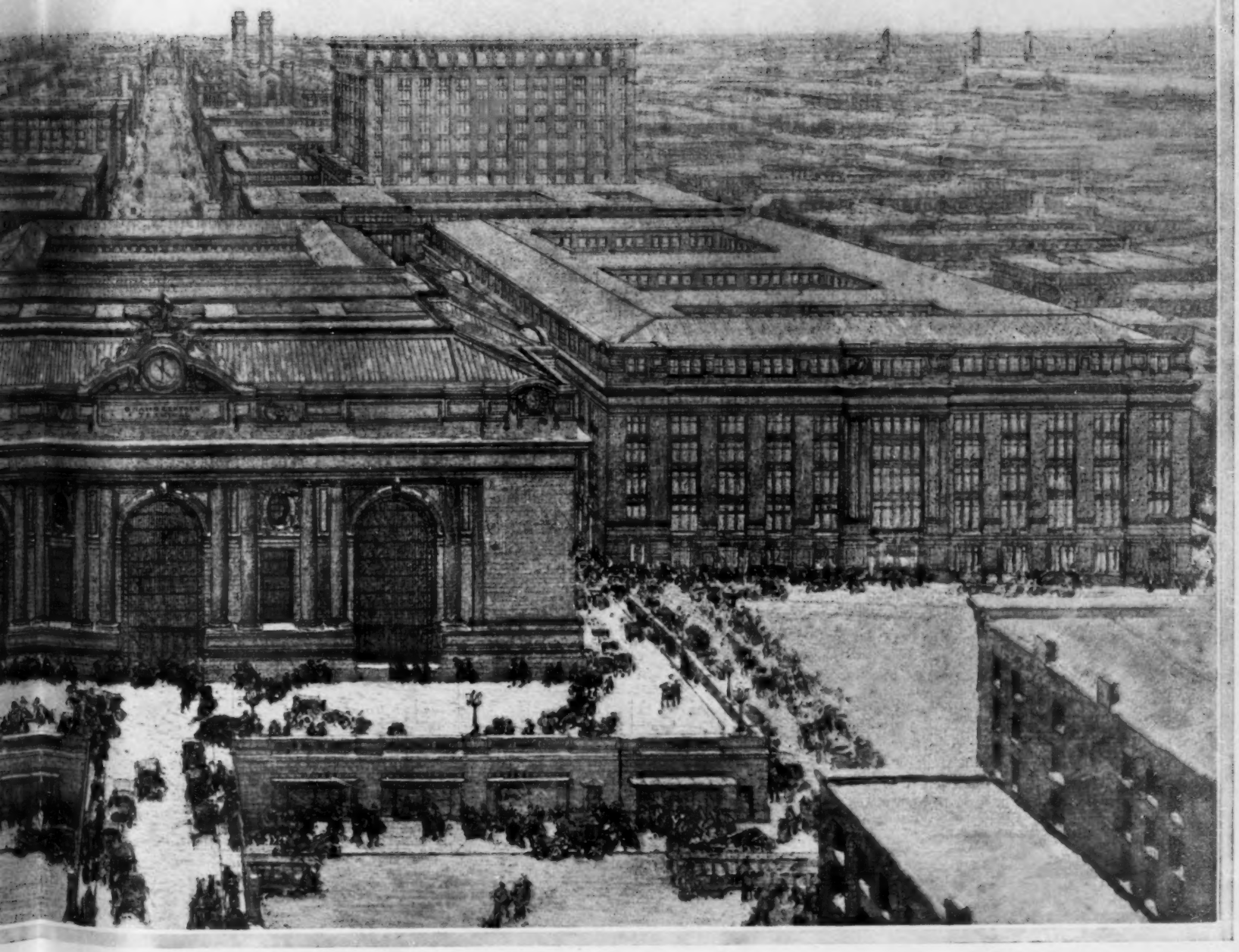
(Concluded on page 490.)



concourse and terminal building. Post office and general railroad office building.

AND TRACKS OF THE GRAND CENTRAL TERMINAL

THE GRAND CENTRAL TERMINAL GROUP OF BUILDINGS.



BUILDINGS—A MONUMENTAL GATEWAY TO A GREAT CITY

Drawn for the *Scientific American* by Jules Guerin.

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

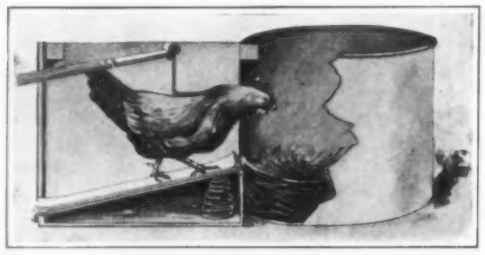
The Hen Her Own Bookkeeper

NO matter how shrewd at sizing up a hen he may think he is, no poultryman can tell with any degree of certainty which are his best layers without keeping an actual record of the laying. As in other walks of life, the credit is quite liable to go to the occasional layer, but constant cackler, while the quiet industrious hen is badly misjudged. In order to determine how much dependence can be put in the judgment of a poultryman, a careful record was kept at an experiment farm in Minnesota. In very few cases did the estimate tally, even approximately, with the actual work of the hen. One hen, which was estimated to lay 250 eggs, laid as a matter of fact only 86 in the year; another hen rated at 208 per year laid only 40. On the other hand, a hen with an 80-egg reputation laid 152, while one estimated to lay 90, actually laid 134. The figures as reported from this experiment station show that it is absolutely necessary for a poultryman to keep accurate records. Otherwise he cannot weed out the poor layers from the good, but must let the lazy hen continue to eat up the profits of the others. Also not knowing the mother of the egg how can the poultryman breed good layers and prize poultry? An accurate pedigree is impossible without constant and tedious watching.

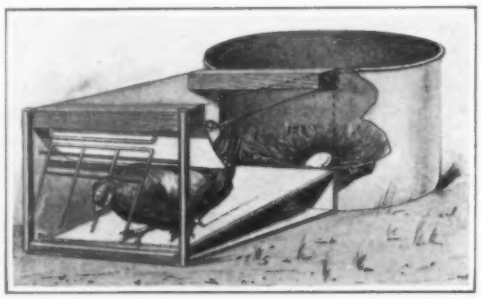
After cogitating on this matter for some time, two

A battery of four nests, one with the gates down.

Staten Island poultrymen conceived the idea of letting the hen keep her own record. They tried out the scheme and found that it worked to perfection. The idea was so novel that they were surprised, when applying for a patent, to find that many others had been endeavoring to devise some scheme for keeping an automatic record of the hen's work. However, while having the same object in view, their methods were entirely different. Some of the patented recording nests were so intricate and required so much of the hen, that no self-respecting fowl would enter them. However, the apparatus devised by these two inventors calls for no work on the part of the hen until she leaves the nest, and then all that she has to do is to stoop under a gate that partially closes the entrance. By so



Entering the nest and springing the gate-trigger.



Crawling out of the nest and registering her autograph.

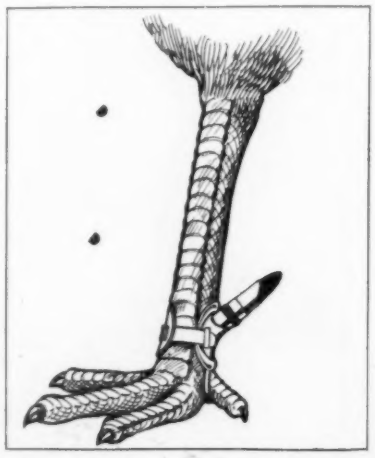
doing she registers her autograph on a piece of paper.

As shown in the drawing, the hen walks up an inclined board to the nest. In so doing she strikes a trigger that releases two gates, which drop down and bar the entrance to any other hen. The inner gate is hung high enough to permit the hen to crawl under it. This is no hardship for the fowl, which no doubt has been educated to crawl under fences. But in squatting so as to crawl under the gate, the hen is obliged to bring a crayon, strapped to her leg, into contact with a piece of paper on the inclined board, thus leaving her autograph after passing out of the nest. The outer gate is easily negotiated; for it consists of a light wire frame that swings outward readily enough. However, this frame will not swing inward, and so acts as a bar against the entrance of any other hens to the nest. The inclined board is mounted on a spring at its inner end, so as to make the nest adaptable to hens of various sizes. After the egg has been laid, the nest remains closed until the poultryman arrives to reset the gate and remove the egg and autograph record of the hen. To distinguish between hens, each is provided with an individual color, and if there are not colors enough to go round, combinations of colors are provided, for a a hen may wear a crayon on each leg. The crayon holders, as shown in the drawing, are secured like the steel spurs of the fighting cock, and are made of aluminium. They are so light and fit so well that the hen does not notice them any more than one notices the ring on his finger. It has been found that the crayons last from six to eight weeks without any attention whatever. Although the device may strike us as amusing because of its novelty, it has clearly proved its efficiency, and is being extensively introduced among poultrymen.

A Mechanical Eye for Burglar Protection

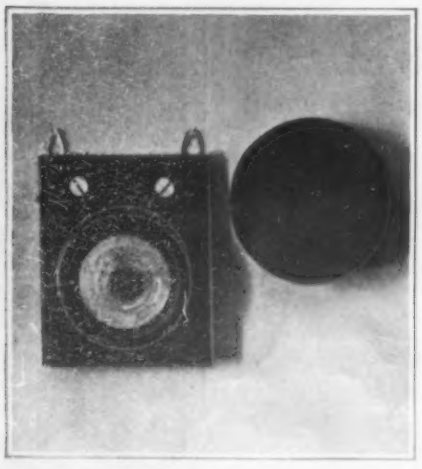
A FRENCH inventor has recently designed a burglar alarm which is a very close mechanical substitute for a human watchman. The device is arranged to operate before the slightest injury has been inflicted upon a safe by a burglar. In fact, it has no material contact with its surroundings, for it includes the mechanical equivalent of an eye which will detect the faint light from a dark lantern or even a match, hence making it a good fire alarm as well as a burglar alarm. As our readers have probably guessed, the "mechanical eye" is a selenium cell, such as used in picture-telegraphing apparatus, for the reason that the electrical conductivity of selenium varies approximately with the amount of light that falls on it. The mechanical eye consists of a cylindrical box, four inches in diameter, and about an inch thick, containing a band of selenium wound up in a coil. There is one of these boxes for each room that it is to be protected, but they all communicate their sensations of light by electricity to a common receiver, which is designed as follows:

In the field of a large horseshoe magnet is suspended a thin wire, about a foot in length. This carries a very light rectangular aluminium frame, wound with a galvanometer wire. The galvanometer coil *A* weighs about an ounce, and has an electrical resistance of five thousand ohms. One terminal of the coil dips into

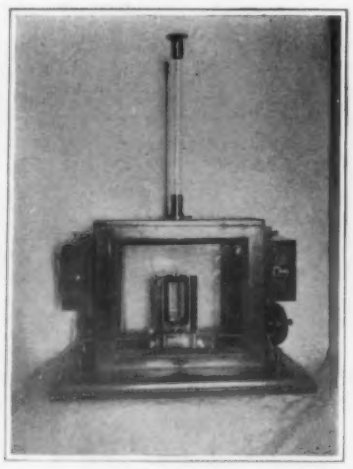


The aluminium crayon-holder on the hen's leg.

a cup of mercury *B*, while the other connects with the suspension wire. The transmitter or mechanical eye *D* is placed in circuit with battery *E*, coil *A* and mercury cup *B*. When a ray of light falls on the cell *D* it varies the strength of the current passing through the coil *A*, causing it to turn, bringing its lower terminal into contact with one or other of the set-screws *F*, and thereby closing a relay circuit containing the alarm gong *G*. The sensitiveness of the receiver may be varied by adjusting the screws *F*. The alarm bell is actuated through the intermediary of a "jack" similar to that used in telephone switchboards, so that once the circuit is closed the bell will continue to ring until it is stopped by throwing a switch. Equipped with this alarm apparatus the good man of the house can slumber in peace, confident that the unblinking selenium eye

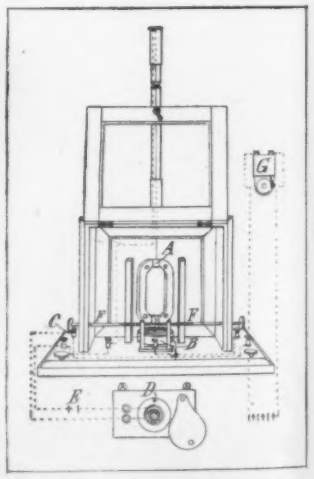


The unblinking selenium eye on the watch for burglars.



The instrument that receives the electrical impulse.

The receiver on a stand at the owner's bedside.



Electrical connections of the receiver.

We believe that orders for nearly every 1913

Cadillac
STANDARD OF THE WORLD

will be placed before winter is half over

The Cadillac has enjoyed many successful, many extraordinary seasons.

1913 is eclipsing all former successes.

Never in its history has Cadillac enthusiasm been so strong, so widespread, so pervasive as now,

The new car has literally taken the country by storm.

The handsome lines, the deep soft upholstery, the yielding springs, the riding qualities of almost velvety smoothness; the quiet engine of abundant power, the flexibility and the remarkable ease of control; the standardization of parts, the durability, the simplicity and the economy of maintenance; the practically 100 per cent efficient Cadillac Delco electrical system of automatic self-cranking and electric lighting, *now in its second successful year on the Cadillac;* these and almost countless other marks of distinction, stamp the Cadillac as a car which leaves nothing to be desired, nothing really worth while which a greater expenditure will procure.

The Cadillac production is large—15,000 cars for 1913—just one of the great elements which make possible the Cadillac car at the Cadillac price.

Before the new model was announced, dealers had contracted for this entire enormous output. They had also placed orders for several thousand more, our acceptance of these additional orders being conditional upon our being able by some means to supply them.

Without seeing the car or even its photograph, more than 3,000 individual purchasers placed their signed orders. They had confidence in the Cadillac car and in the Cadillac Company.

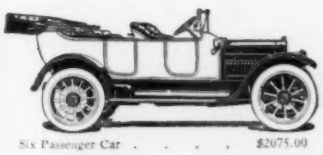
Four thousand of the new cars which have already been delivered have vastly intensified the early enthusiasm. They are proving that the confidence was not misplaced. They are confirming the wisdom of those who placed their orders in advance.

Nearly everyone you meet is—to use a common expression—"Sold on the Cadillac." There seems to be almost none left who are not convinced of Cadillac pre-eminence.

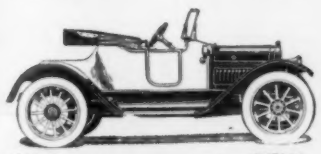
As we said at the outset: We believe that orders for nearly every 1913 Cadillac—including those for spring and summer deliveries—will be placed before winter is half over.

It behooves you, therefore, to arrange for as early a delivery as your dealer can give you.

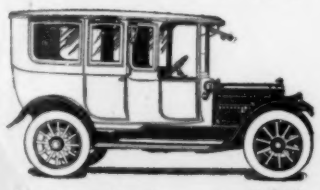
By heeding this advice—given you in all sincerity—you will avoid disappointment. You will also avoid the necessity of compromising on some other car—a proceeding which almost invariably results in an unsatisfied longing in the mind of the man who has once concluded that the Cadillac is the car he *wants*.



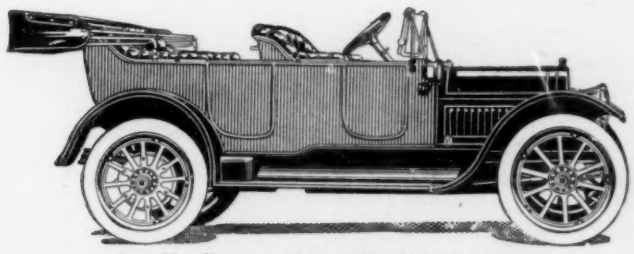
Six Passenger Car $2075.00



Roadster $1975.00

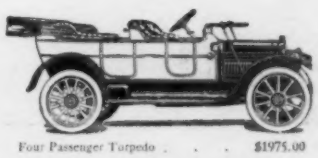


Seven Passenger Limousine . $3250.00

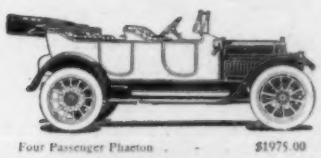


Five Passenger Touring Car $1975.00

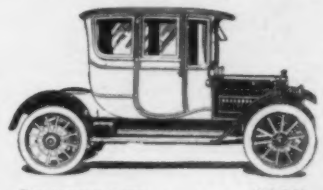
All prices are F. O. B. Detroit, including top, windshield, demountable rims and full equipment.



Four Passenger Torpedo . . . $1975.00



Four Passenger Phaeton . . $1975.00



Four Passenger Coupe . . $2500.00

CADILLAC MOTOR CAR CO.

DETROIT, MICHIGAN

will keep an unremitting watch on his safe or his silver chest. But the eye possesses a failing common to all mechanical substitutes for human agencies. It cannot distinguish between right and wrong. When it sees a light it sounds the alarm regardless of what that light may be. The inventor explains that during the day time the mechanical eye is closed by a lid, but he does not explain what occurs in the early morning. Presumably the alarm is sounded at "peep" of dawn. But perhaps he has some clock mechanism to close the eyelids just before daybreak.

Simplifying Court Procedure in Patent Cases

NEARLY all the witnesses before the House Committee on Patents upon the hearings on the Oldfield bill for the revision of the patent law, and all the writers who have discussed patents in the SCIENTIFIC AMERICAN and SUPPLEMENT, agree that the patent laws of the United States, so far as they define the rights of patent owners, are fundamentally sound, but that all the imperfections which have been imputed to the patent law can be traced to matters of practice and procedure. How such improvements can be effected, without any action on the part of Congress, but simply by act of the courts themselves, has been strikingly illustrated during the past few months.

So notable have been the changes in practice and procedure accomplished by the courts themselves, during the past few months, that it can safely be said that by these changes more has been accomplished to insure perfect operation of the patent laws than would have been accomplished had all the proposals for changing the patent system which have been agitated with increasing fervor in Congress during the past few years been enacted and carried into execution.

The first change related to an evil which patent lawyers have frequently commented on and which lay at the bottom of the case of Westinghouse Company v. Wagner Company, 173 Fed., 361. In that case the Court of Appeals for the Eighth Circuit had affirmed a rule under which all an infringer has to do to secure himself against a recovery of profits is to add something of his own to the complainant's device, a thing which can be easily done in almost any case.

On June 7th, 1912, however, without waiting for any amendments to the law, the Supreme Court of the United States upon an appeal from the case above cited, Westinghouse Electric and Manufacturing Company v. Wagner Electric and Manufacturing Company (225 U. S., 604), reversed the decree of the Circuit Court of Appeals. By this decision of the Supreme Court the following propositions of law became established: If the infringer has sold or used a patented article, the patentee is entitled to recover all of the profits. If a patent, though using old elements, gives the entire value to the combination, the patentee is entitled to recover from an infringer all the profits. If profits are made by using an article patented as an entirety, the infringer is liable for all the profits, unless he can show, and the burden is on him, that the profits are partly the result of some other things used by him. If the infringer, however, by commingling the elements renders it impossible for the patentee to meet the requirement of apportionment, the entire inseparable profit must be given to the patentee. In such a case, as in that of a trustee *ex maleficio* confusing gains, the loss should fall on the guilty and not on the innocent. This rule applies even if the patented device infringed did not preponderate the creation of profits. The owner of a small profit of a fund is equally entitled to protection as the owner of a larger share. While the rule applied may ultimately shift the burden so as to cast it on the defendant, it is justly cast upon one who should bear it, as he wrought the confusion. These rules, be it noted, have thus become law by the decision of the Supreme Court of the United States without the necessity

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 12 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance.

AGENTS WANTED

AGENTS—Ask us about our snappy household specialty line that will clear you $50 to $80 weekly. American Aluminum Co., Division 1029, Lemont, Ills.

BUSINESS OPPORTUNITIES

WHY NOT build up a business of your own? U. S. Chemical Fire Extinguishers easily sell everywhere. 500% profit. Protected territory to local and State representatives. United Mfg. Co., 1204 Jefferson, Toledo, O.

INSTRUCTION

LEARN TO WRITE ADVERTISEMENTS—Earn $25 to $100 weekly. We can positively show you by mail how to increase your salary. Prospectus free. Page-Davis Co., Dept. 89, Chicago, Ill.

POST CARDS

POST CARDS of Irish Scenery, Irish Antiquities, etc.: Famous Liners—White Star, Cunard, etc., Lighthouses—Home and Foreign. Our catalogue and sample post card sent to any address for five cents in stamps. The Lighthouse Literature Mission, Department 1 S.A., Belfast, Ireland.

MISCELLANEOUS

MODEL AND FINE CLOCK TRAIN WORK. Estimates given. Work done by the hour or by contract. Waltham Clock Company, Waltham, Massachusetts.

UNITARIAN LITERATURE SENT FREE upon request. For full particulars please communicate with Mrs. C. P. Seagrave, No. 4 Catalpa Road, Providence, R. I.

INQUIRY COLUMN

Inquiry No. 9288. Wanted the names and addresses of concerns that can coat steel balls with pure tin one-sixteenth of an inch thick.

Inquiry No. 9289. Wanted substance melting at 225° and hardening when cold without imparting any flavor to tobacco smoke and without emitting any oily or fatty vapor.

Inquiry No. 9290. Wanted name and address of a manufacturer of a patented device which is suitable for making up pay envelopes, namely, to fold up bills and insert them with minor coins in a pay envelope of the usual size.

Inquiry No. 9291. Want to buy machinery for manufacturing wooden tooth picks.

Inquiry No. 9292. Wanted a gum that will stick labels to grape-fruit;

Inquiry No. 9293. Wanted the names and addresses of manufacturers of waterproof cloth, also samples of such cloth.

of resorting to any amendment of the patent laws by act of Congress or otherwise.

The other changes which have corrected the practice and procedure under the patent law in the chief respects in which they have been criticised, were accomplished on November 4th, 1912, by the Supreme Court of the United States, when the Court promulgated its Revised Rules of Practice for the Courts of Equity of the United States.

The chief criticism directed against the existing patent system has always been that in patent litigation testimony was ordinarily taken, not in court before a judge, whose good offices could be relied upon to expedite the trial, but out of court before an examiner, who was powerless to control the length of the examination or the prolixity of the testimony. Thus, it was possible to expand the testimony to unseemly length and thus interpose intolerable delays, and well-nigh prohibitive expense upon the weaker litigant. There was also the possibility that even after this enormous bulk of testimony had eventually been passed upon by the court and a decree made thereon, the Appellate Court might reverse the decree and send the whole cause back for a new trial, involving a repetition of the same tedious performance. How this has been revolutionized by the New Rules promulgated by the Supreme Court appears from several of the Rules themselves.

New Rule 46, relating to trials, requires that testimony shall, except in extraordinary cases, be taken in open court. "In all trials in equity," says New Rule 46, "the testimony of witnesses shall be taken orally in open court, except as otherwise provided by statute or these rules. The Court shall pass upon the admissibility of all evidence offered as in actions at law. When evidence is offered and excluded, and the party against whom the ruling is made excepts thereto at the time, the Court shall take and report so much thereof, or make such a statement respecting it, as will clearly show the character of the evidence, the form in which it was offered, the objection made, the ruling, and the exception. If the Appellate Court shall be of opinion that the evidence should have been admitted, it shall not reverse the decree unless it be clearly of opinion that material prejudice will result from an affirmance, in which event it shall direct such further steps as justice may require."

New Rule 47 is even more explicit: "The court, upon application of either party, when allowed by statute, or for good and exceptional cause for departing from the general rule, to be shown by affidavit, may permit the deposition of named witnesses, to be used before the court or upon a reference to a master, to be taken before an examiner or other named officer, upon the notice and terms specified in the order. All depositions taken under a statute, or under any such order of the Court, shall be taken and filed as follows, unless otherwise ordered by the Court or judge for good cause shown. Those of the plaintiff within sixty days from the time the cause is at issue; those of the defendant within thirty days from the expiration of the time for the filing of plaintiff's depositions; and rebutting depositions by either party within twenty days after the time for taking original depositions expires."

New Rule 48 deals directly with the sorest subject of patent practice, namely, the testimony of expert witnesses in patent and trade-mark causes. "In a case involving the validity or scope of a patent or trade-mark," says the rule, "the District Court may, upon petition, order that the testimony in chief of expert witnesses, whose testimony is directed to matters of opinion, be set forth in affidavits and filed as follows: Those of the plaintiff within forty days after the cause is at issue; those of the defendant within twenty days after plaintiff's time has expired; and rebutting affidavits within fifteen days after the expiration of the time for filing original affidavits. Should the opposite party desire the pro-

duction of any affiant for cross-examination, the Court or judge shall, on motion, direct that said cross-examination and any re-examination take place before the Court upon the trial, and unless the affiant is produced and submits to cross-examination in compliance with such direction, his affidavit shall not be used as evidence in the cause."

The zeal of the Supreme Court of the United States to prevent prolixity of testimony and undue expansion of the record appears throughout the New Rules. Thus, depositions before an examiner are expressly permitted to be in narrative form instead of in question and answer. (New Rule 49.) No transcript of evidence before the examiner can include argument or debate. (New Rule 51.)

"The evidence to be included in the record (on appeal) shall not be set forth in full, but shall be stated in simple and condensed form, all parts not essential to the decision of the questions presented by the appeal being omitted and the testimony of witnesses being stated only in narrative form, save that if either party desires it, and the Court or judge so directs, any part of the testimony shall be reproduced in the exact words of the witness." (New Rule 75.)

"In preparing the transcript on an appeal, especial care shall be taken to avoid the inclusion of more than one copy of the same paper and to exclude the formal and immaterial parts of all exhibits, documents and other papers included therein; and for any infraction of this or any kindred rule the Appellate Court may withhold or impose costs as the circumstances of the case and the discouragement of like infractions in the future may require. Costs for such an infraction may be imposed upon offending solicitors as well as parties." (New Rule 76.)

The determination of the Supreme Court to stamp out the common devices by which patent litigation has heretofore been made burdensome is notably expressed in the rule last quoted.

The way of the procrastinator in patent litigation will hereafter be hard. "After the time has elapsed," says New Rule 56, "for taking and filing depositions under these rules, the case shall be placed on the trial calendar. Thereafter no further testimony by deposition shall be taken except for some strong reason shown by affidavit. In every such application the reason why the testimony of the witness cannot be had only on the trial, and why his deposition has not been before taken, shall be set forth, together with the testimony which it is expected the witness will give."

"After a cause shall be placed on the trial calendar," says New Rule 57, "it may be passed over to another day of the same term, by consent of counsel or order of the Court, but shall not be continued beyond the term save in exceptional cases by order of the Court upon good cause shown by affidavit and upon such terms as the Court shall in its discretion impose. Continuances beyond the term by consent of the parties shall be allowed on condition that only a stipulation be signed by counsel for all the parties and that all costs incurred theretofore be paid. Thereupon an order shall be entered, dropping the case from the trial calendar, subject to reinstatement within one year upon application to the Court by either party, in which event it shall be heard at the earliest convenient day. If not so reinstated within one year, the suit shall be dismissed without prejudice to a new one."

The New Rules above quoted will go into effect February 1st, 1913. Alone, and without the necessity of any amendment in the law, they have removed the chief grounds for criticism of the existing patent system. Still more important, they point the way to similar changes in practice which the Patent Office, itself, without the necessity of any act of Congress, may effect in the Patent Office. Finally, they illustrate the futility of seeking, by fundamental changes in the patent system and radical abridgment of the rights of patent owners, to accomplish reforms

which so easily and so completely can be effected without resorting to legislation.

The Limitations of Firearm Silencing

By Hiram Percy Maxim

A VERY interesting play now running in New York depicts a murder by means of a silent-shooting pistol. The different scenes where the pistol is used are most impressive and interesting; but as many people are bound to get an altogether mistaken notion of what can be done in real life with a firearms silencer, it seems worth while to point out some little known information on the subject.

In the play a crook is supposed to have acquired a pistol with a silencer attached to it. He demonstrates it to his friend by actually shooting at a vase of flowers standing on a table. He smashes the vase, or at least, the vase is smashed, and there is no noise from the pistol. Later on, in committing a burglary, he is betrayed by one of his supposed pals. He shoots his betrayer noiselessly with this pistol, while the police are waiting in the next room, and escapes. The police are entirely ignorant of what has occurred. The impression given is that all the real crook need do in order to duplicate in real life what he saw on the stage, is to buy a silencer and attach it to his pistol and go ahead. Fortunately, this is not at all the case, as can be easily seen from a moment's glance of any pistol.

There are two forms of pistols in use to-day. One is the revolver and the other is the automatic pistol. These are the only hand arms which can be secreted and used by the law breaker with any chance of escaping detection. Let us see what happens when we try to silence one of these weapons. The revolver has a cylinder usually carrying six cartridges. This cylinder is revolved by pulling the trigger, the cartridges being successively brought up to a position opposite the barrel ready for firing. The loose joint between the cylinder and the barrel is jumped by the bullet. Of course, a serious gas leakage occurs at this joint, but we have grown accustomed to this and never think of it. Now, suppose we attach a silencer to the muzzle of this revolver. The silencer checks the powder gases and holds them. Obviously, these gases, imprisoned in the barrel and silencer, make their escape at the joint between the cylinder and the barrel already referred to. Instead of there being a flash of fire at the muzzle of the barrel, there is one at the joint. The revolver makes as much noise with the silencer as without it.

The writer has had several interesting experiences in demonstrating this matter before legislative bodies. A few States have considered passing laws prohibiting the use of any device for lessening the noise of firearms, and in many cases the writer has been asked to appear at hearings and show why such laws are not only based upon mistaken ideas, but also why they would be harmful to our many rifle and target shooters. At these hearings, a rifle, a revolver and a Maxim silencer have been used. The silencer was adapted so it could be fitted to a revolver or rifle. A box of sand made a safe bulletstop. The rifle would be fired first with the silencer to show that the silencer would silence. The device would then be placed upon the revolver and one half of those present would be asked to turn their backs and listen to the shots, both with the silencer and without and to say which was which. Those not turning their backs were to see that the experiment was free from all question. The revolver with the silencer would be emptied into the sand box, then reloaded, the silencer attached and emptied again. Then the gentlemen with backs turned would be asked which was which. In no case has it been the writer's experience that the gentlemen were unanimous. Much amusement has always followed. Why any one at all familiar with the revolver should imagine that it could be silenced at the muzzle is a surprising thing in itself.

Now let us turn to the other small arm,

the automatic pistol. This weapon is constructed so that when a cartridge is exploded, the breech immediately opens, ejects the empty shell, throws in the new cartridge and closes the breech again. The recoil performs all these functions. If we attach a silencer to the muzzle of one of these automatic pistols, the powder gases are caught and imprisoned, and when the automatic breech opens, these imprisoned gases are released and blow out backward, sometimes into the face of the shooter. It makes a very dangerous experiment and should never be attempted by those unfamiliar with firearms.

This is why we have no murders by crooks using silencers, except upon the stage. The only weapon with which the silencer really works is the rifle. But even in the rifle there are several important limitations. These concern the noise made by a bullet in its flight through the air, and is a subject which has been touched upon by the writer in the SCIENTIFIC AMERICAN in the past. This article is not quite complete without reference to it. When the rifle bullet travels at a velocity less than 1,100 feet per second, its flight is noiseless, practically speaking. If, however, the velocity exceeds this figure, its flight makes a noise sounding precisely like the crack of a whiplash. Indeed, that which causes the whiplash to "crack" is what causes the bullet to "crack."

A bullet or a whiplash or any other object moving through the air is like a boat sailing through the water. It creates a "bow wave" which trails off to the rear and outwardly. When the velocity of a bullet or other object exceeds a certain amount, this bow wave begins to *break, exactly* the same as the bow wave from a boat breaks when the boat exceeds its characteristic speed. The breaking of a water wave makes a splashing sound. The breaking of an air wave makes a cracking sound. We never heard it until we silenced the gun.

Another very curious thing is the fact that this "breaking" of the wave seems to occur when the bullet acquires the velocity of sound. Any velocity below this appears to be quiet, while any velocity above this makes the noise. The dividing line appears to be a very sharp one.

Thus, even on a rifle, a silencer cannot give absolutely noiseless shooting if ammunition is used which has a bullet velocity in excess of 1,100 feet per second. The silencer will eliminate absolutely the report noise made at the muzzle of the gun, but it cannot of course control the noise that may be made by the bullet in its flight out beyond the gun. Generally speaking, the only standard rifle ammunition for sale which has a bullet velocity *less than 1,100 feet per second* is the 0.22 caliber, for the popular small target shooting rifle. All larger than this have bullet velocities which *exceed 1,100 feet per second.* Shooting to be noiseless enough for the assassin would then be limited to the 0.22 caliber and also to the use of a rifle. This is obviously impractical for the purposes of crime. On the other hand, not only the 0.22 caliber, but all the other calibers are immensely increased in value to the target shooter by a silencer. Not only is the 0.22 caliber made quiet enough so that target practice can be held without creating disturbance, but all the larger calibers can be shot with an entire absence of report concussion and a reduction of 75 per cent of the recoil. As a means of teaching high power rifle shooting, the silencer is indispensable. The United States Government adopted it because its value in instructing recruits is equal to its value in time of war.

Thus, we see that the firearms silencer has limitations. This will spoil many sensational stories and newspaper editorials, but it is nevertheless a fact. There is no way in which the criminal can ever make his revolver or automatic pistol noiseless.

A New Gun for Throwing Bombs and Life Lines

(Concluded from page 479.)

bubble of the circular level *q* occupied on the graduated semi-circle *r*. The proper

elevation could then be given to the bomb gun, at each shot, by bringing the bubble to the position thus determined. In the improved types now constructed the spring gun is replaced by a system of sights provided with mirrors, which reflect the image of the target, through a reticle to the eye of the gunner.

In attacking a place defended by firearms the gunner is protected by a sheet of chrome steel with hinged and adjustable end pieces. This shield, which is large enough to shelter several men, is mounted on two wheels and is easily moved, even over rough ground and small obstacles.

The inventor has employed this gun to throw a perforated bomb containing asphyxiating liquids and powders. A detonator, immersed in the mass, is exploded by a wick which is ignited by the combustion of the firing charge. In experiments conducted in the presence of the prefect of police and other officials a room more than three hundred feet distant from the gun, was made uninhabitable in a few seconds.

For fighting fire, the gun is charged with five or six pounds of a dry powder which quickly extinguishes an incipient conflagration, even if it has already become too hot to be approached. The extinction is certain in a confined space. It is less certain in the open air, if only one gun is used, but two or more guns fired simultaneously or in rapid succession are reasonably sure to accomplish the desired result. The powder, projected in a closed room, confines the flames within a small space, extinguishes them in its passage and covers the embers with a coating that excludes the air and disengages gases which prevent combustion. The efficacy of the process is due to the simultaneous action of the powder on all parts of the fire. The blast of powder attains a diameter of 10 or 12 feet at a distance of 25 feet from the gun, and covers an area of 200 square feet.

The Mathiot gun is well adapted for throwing life-lines. The barrel of the gun has a longitudinal groove to receive the line attached to the projectile, and the line is in no danger of being cut, frayed or ruptured, as the pressure and the initial velocity are small, although a long range can be obtained with a sufficiently heavy projectile. The construction of the projectile varies according to the special conditions of its use. It is usually made of wood, but it may be made of iron, with an air chamber in front to give it buoyancy in water. Some projectiles are of the rocket type and propel themselves by the steady burning of a fuse or by successive explosions.

Finally, the Mathiot gun may advantageously be employed in war for throwing small bombs of various kinds to a moderate distance with a very satisfactory degree of precision.

How Electricity Makes the Dairy Cleaner

(Concluded from page 488.)

ing; but later on electricity was introduced for lighting in the cow stables, creamery and horse stables.

In the interior views of the cow stable the electric lamp bulbs may be just distinguished, as they are close up to the ceiling and are set in watertight fixtures.

Consideration of all conditions that may point the way toward "cleaner" milk is desirable from the fact that our State and municipal authorities have not yet fully realized the gravity of the situation generally. There are, to be sure, several dairy farms such as here described, where milk is produced for commercial use under conditions that are practically perfect. But considerable of the milk still used is not prepared in this way, and unless "pasteurized" it of necessity is an injurious food, particularly for infants and children—the greatest milk consumers.

It is a well-established belief among those in a position to know, that tuberculosis, typhoid and scarlet fevers and diphtheria can be transmitted to human be-

ings through the drinking of raw milk in which these germs exist. Consequently, the welfare of the future generation depends upon the methods employed to-day in safeguarding our milk supply. The improvement in dairy conditions during the past few years has been marked, and is a result of the greater dissemination of knowledge as to the seriousness of carelessness in the preparation and handling of milk as a food product. During the last year or two there has been a striking decrease in the infant mortality in those places where milk conditions are under careful surveillance. Many lives have been saved and numerous chances of disease avoided by more careful attention to the health of the dairymen, as well as of the cows, and the handling of the milk at the farm, in transportation, and distribution.

The introduction of electricity on the dairy farm requires a better class of labor. The devices need a little skill in their handling. Such apparatus, however, simplifies labor conditions, and fewer persons, where the work is done by electricity, will accomplish the same or greater work. Improvements of this character must necessarily make for better conditions and are desirable not alone for their commercial gain, but because they are a benefit to humanity.

It can no longer be doubted that dairy products—and this term includes milk, cream, ice cream, butter and cheese—are excellent vehicles for the dissemination of pathogenic bacteria. Outbreaks of typhoid fever, scarlet fever, diphtheria, sore throat and intestinal disorders of children have been definitely traced to contaminated milk. The proofs of the danger of tuberculosis infection from these products are accumulating daily. The opportunities for such infection are manifold. With the greatest vigilance on the part of the trained inspectors and the best care on the part of the consumer, this infection cannot be entirely prevented.

Of course, the carrying out of the recommendations for the production of more sanitary milk, entails additional expense at the farm. But the receipt of a single additional cent per quart of milk would justify many improvements in the average dairy. A single case of sickness from contaminated milk would cost far more than the slight additional price of better milk for a long period.

It is both interesting and important, however, to note that where electric systems are properly planned and correctly installed they invariably result in decreased cost of operation, if one is careful to include all proper costs when making the comparison; and this statement holds good no matter whether it be applied to the subject of electric power or to lighting only. There are some conditions under which an exception might be made for other reasons, as for instance, where live steam is near at hand. For sterilizing purposes it might be needed in any event. Such cases, therefore, must be determined on their merits. As a general rule, the use of electricity in the dairy will result in economy of operation; and, as an element of modern dairy equipment, it suggests the greatest single influence toward increased cleanliness.

Monumental Gateway to a Great City

(*Concluded from page 487.*)

sengers, the incoming baggage being unloaded beyond where the passengers leave the train, and the outgoing baggage being brought up to the baggage cars at the front of the train, from the subways already alluded to. In agreement with the principle of complete segregation of the various classes of passengers, there are two large waiting rooms adjoining the Forty-second Street entrances, one for through long-distance passengers, and another immediately below it for suburban service; each being on the level of the track which it serves. Everything—ticket offices, entrances, and exits to the express and suburban service, will be entirely distinct and separate, each having

its own concourse, its own information bureau, its own baggage checking places, parcel room, and other facilities for travel. The concourse for inbound trains can comfortably hold eight thousand people; that for outbound trains, fifteen thousand. The waiting room will accommodate about five thousand more; and altogether this great station can take care of nearly thirty thousand people, without subjecting them to uncomfortable crowding. It is estimated that seventy thousand outbound passengers can pass through the terminal in an hour; which is double the maximum carrying power of any passenger station existing to-day.

Great Train Capacity.

The great train capacity of the station, estimated at a maximum of two hundred trains an hour, is due to the introduction of the loop system, both for express and suburban service. Instead of trains coming in, discharging passengers and backing out, they will continue, when empty, around a loop under the southerly front of the station; and then will run over to the yard at one side of the station yard, where they will be cleaned and made ready for the next trip. It may be mentioned here that not only has electricity rendered possible this underground and entirely enclosed station, but it has cut out a large amount of switching.

All-electric Signal System.

Mention should be made of the all-electric signal system, the only one of its kind in the United States. The main signal tower is a four-story building, below street level, in which are housed the interlocking machines by which the signals and switches are operated. The machine for the suburban level is the largest ever built; it contains four hundred levers, and on the floor above is a machine with three hundred and sixty-two levers, operating the switches and signals on the express level. The movement of the trains is indicated by little electric lights on a chart which is a fac-simile of the track layout of the yard. The switches and signals are, of course, interlocked. Altogether in the whole yard there are over one thousand separate levers. Attention is drawn to the fact that, when the gate to the train platform is closed, its shutting gives an electric signal, not only to the train, but to the signal towers clear up the main line—an arrangement which will save minutes of time over the old method.

In conclusion, note should be made of the sectional view of the new terminal station, which is shown on page 484 of this issue; and more particularly we direct attention to the lower right hand section of the drawing, in which is shown the remarkable concentration of subway, street surface and elevated lines, which occurs at the new terminal on Forty-second Street. Passengers, on arriving in New York will find themselves in immediate touch with half a dozen distinct lines of transportation by elevated railway, surface car, or subway as the case may be. From the terminal any section of Greater New York may be reached—in most cases without change of cars. At street level, running past the entrance to the terminals, are the surface cars of several of the main lines of travel north and south through the avenues, and east and west through the streets of the city. Above these is the terminal station of a short branch of the elevated system, which puts the passenger in touch with the east side system of elevated roads throughout the length of Manhattan and the Bronx. Immediately below street level is the four-track express subway of the Interborough Company; and below that will be the new subway of the Hudson and Manhattan Railway by which passengers can proceed direct to the terminals of the western railroads which enter Jersey City. Below that, again, is the Belmont tunnel to Long Island. Broad inclined planes and spacious footways will enable passengers to proceed direct from their trains to anyone of the three subways, the surface cars, or the elevated trains.

In all probability the Grand Central

Terminal will always remain the most extensive and in every way the most notable terminal station in the world. That it will for all time prove sufficient to meet the growing traffic of the future no one for a moment believes. Some day the growth of the city and the ever-swelling tide of travel will have overtaken and swamped even this great structure. When that time comes, entirely new adjustments will have to be made, and, possibly, the great terminal of to-day will be replaced by one north of the Harlem River—a suggestion, by the way, which came up for discussion when the plans of the present terminal were being considered.

Paris Wireless and the Time of Day

By the Paris Correspondent of the Scientific American

THE International Time Conference recently finished its work at the Paris Observatory, which was chosen for the meetings, and some resolutions of interest were decided. One of the principal decisions is that all the researches made in different observatories all over the world as concerns the determining, preserving and transmission of time, are to be henceforth centralized at Paris. A competitor for such a horary center was the powerful German wireless telegraph station of Norddeich which, like the Eiffel Tower, is now engaged in sending out regular time signals each night, but the German delegation finally entered into the present agreement. The choice of Paris as a center point is due among others to the use of the Eiffel Tower for wireless signaling as being the highest in the world, and also to the established reputation of the observatory, one of whose eminent members, M. Ch. Nordmann, supplied me with the present information.

Besides the tower, whose signals carry for nearly 4,000 miles at present, but which is not sufficient for more distant points, there are chosen a certain number of other stations encircling the globe, and all these will be regulated according to the tower plant. Each station in turn will serve as a center for sending out time signals over a given radius, these to be sent at different hours of the day so as not to interfere with each other. When all the stations are working it is not too much to say that all points on the earth's surface will receive time signals twice a day at least, for the use of navigators, explorers, surveyors, railroads, scientific stations, clockmakers and the like, giving the exact time within one tenth of a second. It was decided that the time in all cases is to be based on the Greenwich meridian as a standard, to which it is easy to bring the local time at any spot by astronomical observations. In this way navigators are able to find their bearings no matter what station may be sending the time signals, by referring to the chart. The stations which are chosen by the conference to act as time signal stations are as follows, and accompanying each is the figure for Greenwich time, which each one will send out. For this there is used the new 24-hour time notation, starting from midnight as usual, but counting 24 hours for the entire day up to the following midnight. Thus 3 o'clock P. M. is now 15, hours, etc. Stations: Paris, midnight and 10 hours; San Fernando, Brazil, 2 and 16 hours. Arlington, U. S. A., 3 and 17 hours; Mogadiscio (Somali region) and Manila, 4 hours; Timbuctoo, 6 hours; Norddeich, Germany (the great wireless station), noon and 22 hours; Massaouh (Erythrea), 18 hours; San Francisco, 20 hours. However, it should be stated that these decisions are of a scientific but not a governmental order, and it is now required that each of the respective governments enter into the scheme. No doubt this will follow, as it is now recognized that the wireless time signals will have a great practical value.

The Tenth International Congress of Agriculture will be held at Ghent, Belgium, June 8th to 13th, 1913. The general secretary is M. Paul de Vuyst, director-general of the Rural Office in Brussels.

RECENTLY PATENTED INVENTIONS

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Of General Interest.

MEANS FOR PACKING FRESH PINEAPPLES.—H. B. KOPF, P. O. Box 1236, New Haven, Conn. This invention has particular reference to means or method of packing fresh pineapples which may have become substantially ripe before being gathered, whereby they may be shipped with safety and whereby the highest market prices are attainable.

EQUILIBRATOR.—MELVIN VANIMAN, deceased, care of Gustav Bissing, 2 Rector St., New York, N. Y. This invention relates to a combined equilibrator and ballast, more applicable to aeronautic devices, and an object of the invention is to provide means for quickly raising water-ballast to the aeronautic ship while sailing over the water, which may, if desired, be used as a drag. The device of the indicated character is provided, which, in passing through the water, will offer a minimum resistance to the movements of the aeronautic ship.

LOOSE LEAF BINDER.—J. T. BRINK, Station C, 414 Broadway Ave., Topeka, and H. NORDSTROM, Topeka, Kan. The purpose of the invention is to provide a new and improved form of loose leaf binder constructed so as to be of substantially unlimited capacity, and capable of quick and easy opening and closing for inserting or removing leaves.

TRANSOM LIFTER.—J. H. GARTNER, 631 South Main St., Pocatello, Idaho. In this case a vertically slidable rod is employed, but the upper end of the same is connected with the transom proper by means of a spring, which is held slidably in a curved guide attached to the door casing; and the rod is operated, that is, adjusted vertically, and locked in any position, by improved means.

INVALID'S BODY SUPPORT.—E. S. WEAVER, P. O. Box 8, Arapahoe, N. C. An object here is to provide a device by means of which a person, such as a paralytic, who is deprived of the use of some of his limbs, may be enabled to support his body and even to walk. Further to provide a device by means of which a leg which has been paralyzed or otherwise rendered unable to support the body may be moved so as to aid in walking.

OILER.—R. H. EVANS, care of Grand Central Hotel Nelson, Riondel, British Columbia, Canada. This invention provides an apparatus wherein provision is made for the exclusion of extraneous matter, such as grit, dust or water; provides means for insuring the supply of oil when desired; to avoid leakage of oil from the apparatus; to insure the steady delivery of oil during the use of the oiler; and to provide means for locking the device in sealed position, to prevent the delivery of oil there from.

Heating and Lighting.

GAS BURNER.—W. N. BEST, SR., 11 Broadway, New York, N. Y. The special aim of this inventor is to so construct the burner that the combustible gas after escaping will become mixed with air and burn closely adjacent the surface of the refractory material, which last will retain the heat and facilitate the combustion.

METHOD OF PRODUCING LAMP CHIMNEYS.—W. J. WAMBAUGH, Box 723 Morgantown, W. Va. The object here is to produce a chimney having an ornamental top which does not require a relative thickness of glass at the top, but in which the top and body of the chimney are of uniform thickness, thus doing away with the excess of breakage due to unequal expansion and contraction of the relatively thick top and thin body.

TUBE SCRAPER.—M. J. THORSEN, 324 Park Ave., Weehawken, N. J. The invention has reference generally to boiler tube scrapers and more particularly is directed to a device designed to more thoroughly and effectively clean such tubes in the manner designed to prevent the material scraped from the tube from becoming wedged therein and clogging the same.

GAS GENERATOR.—R. C. BRADLEY, 337 De Sird St., Shreveport, La. An object here is to provide a light, compact, and easily transportable device especially designed for use with prepared cartridges, and having means for moving the cartridge into or out of the water, and for sealing the cartridge in a holder when not in action.

Household Utilities.

WASHBOARD.—MARTHA A. MORSE, 230 Keap St., Brooklyn, N. Y. The object here is to provide an improved means for retaining the soap or other cleaning agent that may be used, in convenient position, with a view to its ready application by the user to the cloth, which is being rubbed upon the board for the purpose of cleaning the same.

EXTENSION TABLE.—S. R. LIBBEY, Cottonwood, Idaho. The invention provides a table having disappearing leaves which may be brought into or out of place by the act of pulling the ends of the table apart or pushing them together. Novel means provide for raising the leaves into place or for causing their disappearance.

ROTARY PUMPS AND ENGINES

Their Origin and Development

An important series of papers giving a historical resume of the rotary pump and engine from 1588 and illustrated with clear drawings showing the construction of various forms of pumps and engines. 38 illustrations. Contained in Supplements 1109, 1110, 1111. Price 10 cents each. For sale by Munn & Co., Inc., and all newsdealers.

Machines and Mechanical Devices.

POWER TRANSMITTING DEVICE.—J. W. STOKER, 612 E. Harrison St., Marion, Ind. An object in this case is to provide a device for increasing power, which is made of few parts and is not liable to get out of order. A further purpose is to provide a device arranged so that by a slight change the ratio of the increase of power may be varied.

DAVIT.—O. E. KNOPH, care of Hans Bugge, 407 Sunset Bldg., Bellingham, Wash. This davit may be quickly operated to extend outward a track on which the supporting carriage may travel, the means for extending outward the track, and for supporting the carriage on the track after it is extended, being operable by a single member under the control of one man.

GRAIN ELEVATOR.—R. L. MAPSON, La Mesa, Cal. This invention provides a conveyor and elevator adapted to be disposed at a plurality of angles relatively to one another, by means of which grain may be conveyed from a plurality of positions to be fed into a threshing machine which remains stationary, there being means connected with the threshing machine adapted for driving the elevator and conveyer.

APPARATUS FOR ISSUING OR DELIVERING TICKETS AND OTHER ARTICLES.—G. I. F. SOULAGE, 44 Rue Chanzy, Paris, France. In this invention the actuation of the devices in withdrawing the ticket or other article at the same time actuates an apparatus which adds the price of the ticket withdrawn to the total value of the tickets previously registered. The apparatus therefore comprises: a delivery apparatus, and adding apparatus for totalizing the value of the tickets issued.

MOLD.—W. J. BOYD, SR., care of H. Anderson, McLeansboro, Ill. This mold has a frame with two sprocket wheels, one journaled at each end, with sproket chains disposed around the sproket wheels, and connected with fulcrum members mounted to slide on the frame, so that when one of the sprocket wheels is rotated the fulcrum members will be moved relatively to the frame, and the arms which are pivotally connected with the fulcrum members, and with the mold-side members will be moved to push the last into position.

WEB OR FILM FEEDING MECHANISM.—J. URIE, care of L. G. Erb, 1062 Clay Ave., New York, N. Y. This inventor provides a mechanism, which permits proper feeding of the web or film and at the same time allows an accurate taking or projecting of pictures without jerk or jar of the film or web, thus avoiding the usual flicker of the picture projected on the screen.

Prime Movers and Their Accessories.

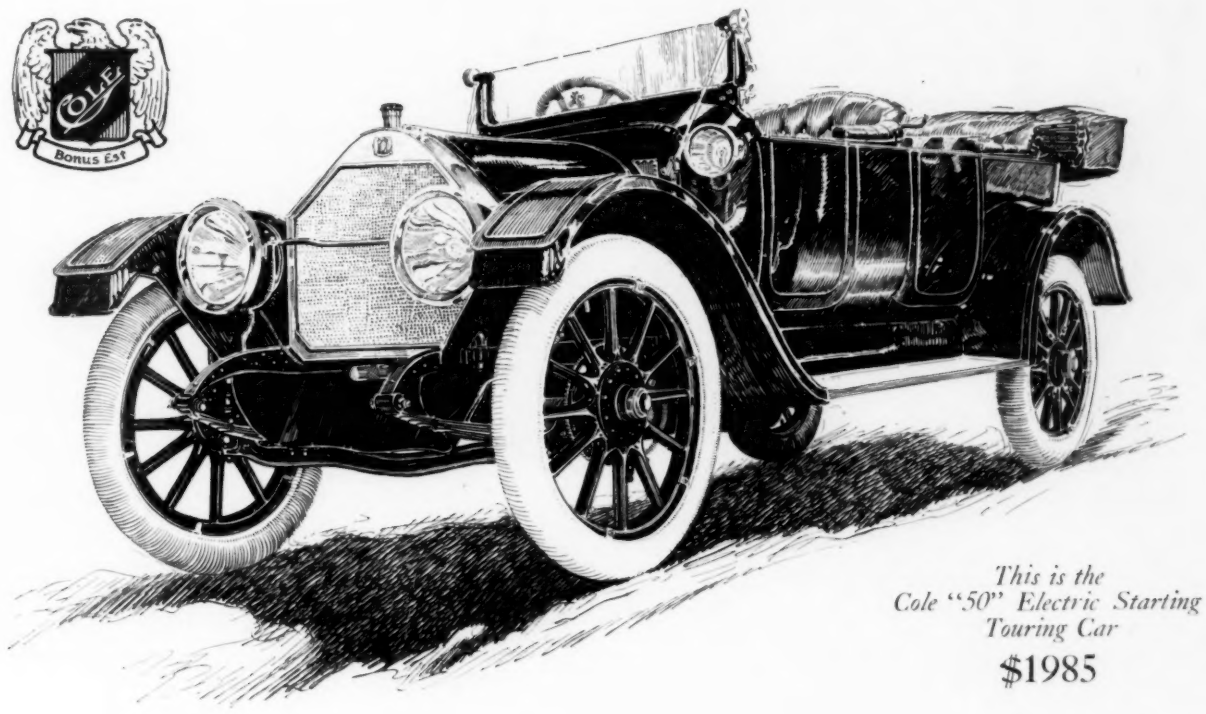
AUTOMATIC STEAM FEED AND PISTON ROD SUPPORT.—W. VAN DER LEAST, Nespit, Wis. The object of this invention is to provide a steam feed and piston rod support for use in the steam feed cylinder, for supporting the piston rod to prevent sagging and consequent wear on the packings and loss of power.

PRESSURE GAGE.—E. J. HAVERLY, Sayre, Pa. This invention relates generally to pressure gages and more particularly to an adjustable means of connection between the expansible element and the intermediate actuating devices for the pointer. The construction and arrangement of the parts are such that adjustments may be made without dismantling the gage.

CARBURETER.—L. SLIGER, 2305 Delware St., Indianapolis, Ind. The objects of this invention are to more thoroughly atomize the hydro-carbon liquid; to maintain hydro-carbon spray as near as practicable centrally in relation to the atomizing chamber through which it is forced to the engine throttle; to heat the atomizing chamber by aid of waste engine gases; to adopt the carbureter in connection with a variable damper; to provide an arrangement for controlling the needle valve in atomizing; and to provide an adjustable float within the apparatus.

PRESSURE GAGE.—J. OKILL, 39 Highfield Grove, Rock Ferry, Cheshire, England. This invention relates to pressure gages, and has for its purpose to construct a simple and convenient gage for measurement of the maximum pressure attained in fluctuating or pulsating pressure such as is produced in the cylinders of internal combustion engines.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.



This is the Cole "50" Electric Starting Touring Car

$1985

Remember when you bought your first

motor car—the wise front you put up when the salesman began jabbering about the "carburetor" and the "differential"?

You were depending then on the other fellow. He told you what you wanted. Now, you yourself *know* what you want, and say so in no uncertain tones.

"I want a car my wife can start every time from the driver's seat by merely pressing a button.

"I want electric lights, three-point suspension, unit power plant and enclosed valves.

"My car must have long wheel base, elliptic springs and gasoline pressure feed service tank in the rear.

"Put everything the driver needs right on the dash within easy reach.

"Give me a big roomy tonneau—plenty of sprawl room and thick, luxurious upholstering.

"Add to this a big, powerful silent motor that *is* silent—that does not falter at mud and hills.

"Then if your car has distinction—personality, if you please—and is backed by a big, dependable organization, if I can buy all this at $2000 or less, bring out your order blank." Now, if the salesman you happen to be talking to represents the COLE, you have closed the deal—then and there—because you've taken the specifications of the COLE off our lips.

Series Eight

COLE

THREE CHASSIS THREE PRICES

All equipped with Delco Electric Starter, lighting and ignition.

Cole "40" 116-in. wheel base, completely equipped $1685

Cole "50" 122-in. wheel base, completely equipped $1985

New Cole Six Cylinder "60" 132-in. wheel base, completely equipped . $2485

All the same quality—merely diamonds of varying karat

Whether or not you are an experienced motorist, get the Cole Blue Book, a 64-page liberal gasoline education—it is worth while. Fill out the coupon today—you may be too busy tomorrow.

Cole Motor Car Co. - Indianapolis

The Cole may be seen at either the New York or Chicago Shows

COUPON FOR YOUR CONVENIENCE

COLE MOTOR CAR CO., INDIANAPOLIS

Without obligation to myself, send me at once the Cole Blue Book. You interest me.

Name _____

Address _____

Will there be a Victrola in your home this Christmas?

You can search the whole world over and not find another gift that will bring so much pleasure to every member of the family

This is a
Victrola XI, $100
Mahogany or oak
Other styles $15 to $200

Any Victor dealer in any city in the world will gladly play any music you wish to hear and demonstrate to you the wonderful Victrola.

Victor Talking Machine Co., Camden, N. J., U. S. A.

Berliner Gramophone Co., Montreal, Canadian Distributors

New Victor Records are on sale at all dealers on the 28th of each month.

Always use Victor Machines with Victor Records and Victor Needles—**the combination.** There is no other way to get the unequaled Victor tone.

Victor Steel Needles, 6 cents per 100.
Victor Fibre Needles, 50 cents per 100 (can be repointed and used eight times).

Victor
"HIS MASTER'S VOICE"
REG. U.S. PAT. OFF.